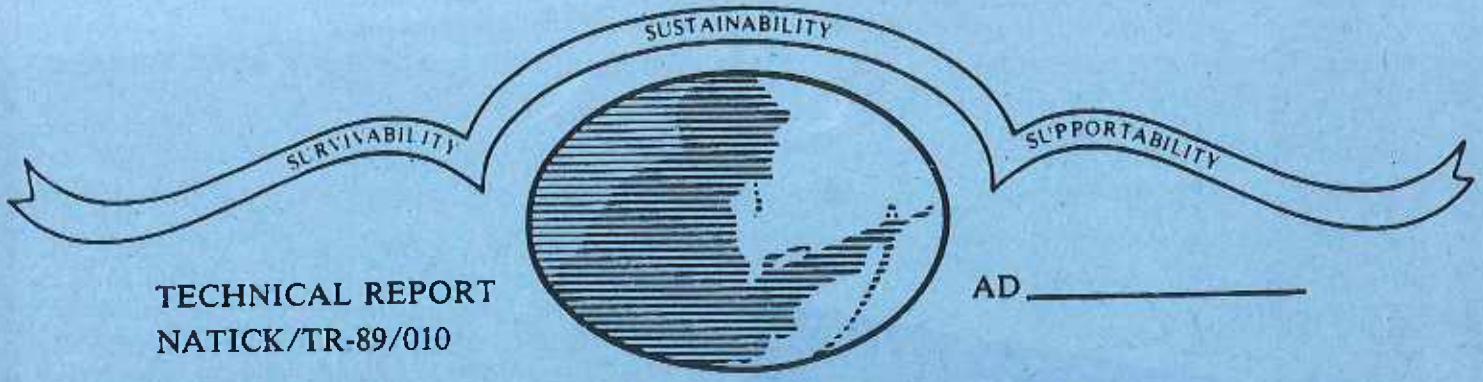

TECHNICAL REPORT
NATICK/TR-89/010

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HOSPITAL LIQUID DIET EVALUATION, TWO-DAY MENU

BY

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SCIENCE AND ADVANCED TECHNOLOGY DIRECTORATE

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The acceptance and consumption of a new two-day hospital liquid diet were evaluated and compared to the liquid diets currently served at eight military hospitals. On alternating days, patients whose jaws were wired because of a dental procedure or jaw injury were served the new liquid diet or the hospital's current liquid diet for a total of four days. Nine-point scales were used by patients to rate the appearance, flavor, texture, consistency, ease of sipping, portion size, and overall acceptability of each liquid item they were served. The volume of each item was measured before each meal, and leftovers were measured after each meal to determine patients' consumption of the liquids. A questionnaire was filled out by dietitians to obtain their opinions about the two diets. Dietitians indicated a clear preference for the new liquid products in comparison to the current products because they are standardized and can be

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#19 ABSTRACT (Cont.)

prepared more quickly, more easily, and in a more sanitary manner. In general, both the new and current liquids were acceptable to patients. The new products had an advantage over the current products with regard to certain characteristics such as texture, consistency, and ease of sipping, particularly for foods that are ordinarily difficult to liquify, such as meats. However, the overall acceptability of the breakfast foods and the milkshakes was rated higher for the current diet than the new diet. One suggestion for improvement of the new diet is to add soups to the menus, or, alternatively, to call some of the vegetable products "soups", as soups are well-liked and are more familiar in liquid form than vegetables. In general, nutrient and caloric intake was sufficient for male subjects. For females, intake of certain vitamins and minerals was low. Since most subjects were unable to consume the large quantity of liquids served at each meal (about 1700 cc), it may be beneficial to reduce the portion size of the liquids from eight ounces to six ounces, while maintaining the diet's caloric and nutrient content.

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PREFACE

The authors would like to thank COL Cronin and MAJ Stoehr (Army Office of The Surgeon General), for coordinating the study at the various test sites; CDR Morrison (Bethesda Naval Hospital) and COL Chambers (Malcolm Grow Medical Center), for coordinating the study for the Navy and the Air Force, respectively. Special thanks are extended to the POCs at each of the eight participating hospitals, without whose cooperation and assistance this evaluation could not have been conducted: CPT Coffey and CPT Robotham, Womack Army Hospital; LTC Boyd, LT Anderson and LT Kist, Darnall Army Community Hospital; LTC Cooke, Madigan Army Medical Center; CPT LaCroix, 97th General Hospital; MAJ Turcotte, 121st Evacuation Hospital; CPT Hosken and LT Monteleone, Wilford Hall USAF Medical Center; MAJ Renoudet and CPT Lindberg, Malcolm Grow USAF Medical Center; and CDR Morrison and Ms. Mackey, Bethesda Naval Hospital. Additional thanks go to the other dietitians, diet technicians, diet aides, and food service workers, as well as to the patients who participated in the evaluation.

The authors would also like to thank Ms. Susan Erickson, project officer for Dental Liquid Products (Food Engineering Directorate, Natick), for providing the nutrient data base and the specifications for the new liquid products, for making the products available for the test, and shipping them to each of the eight participating hospitals. Thanks are also extended to Mr. Larry Lesher for providing statistical support to the project.

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INTRODUCTION

The need for the development of a Hospital Ration, or dental liquid diet, was identified by the Office of The Surgeon General as a DoD Food and Nutrition RDTE & E Program requirement in 1984[1]. A complete oral liquid diet (advanced full liquid diet, dental liquid diet) provides total nutritional maintenance for patients who do not have digestive problems, but for a variety of reasons cannot or will not eat solid foods[2].

A new liquid hospital ration is needed for a number of reasons. The products currently used in hospitals are extremely labor intensive in terms of preparation. In many cases, regular menu items are used for liquid diets; in addition to normal preparation time, the foods must be pureed and mixed with liquids until the product has an adequate consistency. When prepared in this manner, many liquid diet products are unacceptable on a number of sensory characteristics[1]. Intake of these diets is often inadequate as well[3]. In a survey of 300 civilian hospitals throughout the United States, it was found that the caloric intake of full liquid diets ranged from 600 to 2700 kcal/day. The mean intake was found to be 1703 kcal/day, and in 27% of the cases, caloric intake was less than 1500 kcal/day[3].

The lack of adequate commercial products is another reason that the development of a liquid hospital ration by the military is necessary. Commercial products presently available are sweet, milkshake-type drinks that come in a limited variety of flavors. Since many patients may be consuming a liquid diet for a period of

weeks or even months, these products do not offer enough variety. It has been shown that monotony in a diet results in a decrease in the palatability of the diet and, consequently, a decrease in intake[4]. Patients who can consume only liquids for a long period of time may lose a significant amount of weight and become malnourished[1]. Clearly, there is a need for a standard dental liquid diet which is easy to prepare, acceptable in taste as well as other sensory characteristics, adequate in variety, high in nutritional quality, and available for military use in either permanent or field hospital facilities.

The DoD Program requirement mentioned above[1] includes specific technical characteristics for the new ration. The daily ration must include a breakfast entree and cereal, an entree, starch, vegetable, and dessert for the midday and evening meals, and six different flavors of between-meal nutritional supplements (similar to milkshakes). The products must be dehydrated and easily reconstituted with either hot or cold water. The ration must have a shelf life of three years or more without refrigeration. The ration must provide at least 2500 kcal/day and 80% of the RDA for men between the ages of 19 and 51. The components of the ration must be packaged individually with preparation instructions written on each package, and the individual portion size of each meal component must not be larger than eight ounces. Finally, all of the products must be acceptable in terms of a number of sensory characteristics and provide adequate satiety.

In accordance with these guidelines, a new hospital advanced liquid diet was developed by the Food Engineering Directorate

(FED) at the U.S. Army Natick Research, Development and Engineering Center (Natick). The diet includes twenty powders that, when reconstituted with either milk or water, taste like components of a normal meal. The two-day diet contains, on average, 2500 to 3100 kilocalories/day. Protein, carbohydrate and fat make up, respectively, about 12%, 45%, and 43% of the daily caloric intake, depending on the consumption of supplements during the meal, such as juices, carbonated beverages, milkshakes, hot chocolate, and milk. During peacetime, the products are designed for dental surgery and jaw injury patients who require an advanced liquid diet. The products would also be included in the pre-position war reserve stock.

A typical example of an advanced liquid diet menu, supplemented with the aforementioned beverages, would be: for breakfast, cheese omelet and Farina cereal; for lunch, turkey and gravy, sweet potatoes, cauliflower, and chocolate peppermint pudding; for dinner, chili, macaroni and cheese, corn, and vanilla pudding. A complete description of the two-day menu including the nutritional content of the liquid products can be found in Appendix A.

In addition to the two-day liquid diet menu, new between-meal nutritional supplements (milkshakes) have been developed at Natick. These are available in six different flavors: vanilla, chocolate, strawberry, eggnog, orange, and banana. Each nutritional supplement contains approximately 19 g protein, 65 g carbohydrate, and 9 g fat, and provides 416 additional calories. See Appendix B for a complete description of the nutritional content of the between-meal supplements.

An earlier version of the liquid hospital ration, which was developed and produced by the Food Engineering Directorate (FED) at Natick, was tested at four military hospitals in 1983[5]. Responses were obtained from 23 patients over a seven-month period. Patients were asked to evaluate the new liquid products as well as the liquid meals they had been consuming during their present hospitalization, and to compare the two types of products. Patients liked the new products better than the hospital's current products. The overall rating for the new products was significantly higher than the overall rating for the products that were being served at the hospital at that time. Most of the individual meal components of the new diet were well-liked.

Dietitians' opinions of the 1983 liquid diet products were elicited through questionnaires sent to each hospital. Dietitians reported that they would use the products if they were available. However, despite the higher ratings of the new products by patients, dietitians in three of the four testing hospitals felt that the new items were "neither better nor worse" than the hospitals' regular liquid diet items.

Problems with the liquid products that were encountered in this preliminary study have been addressed by the product developers. Green beans, which were given a less than neutral rating, were replaced with cauliflower. Because it was difficult to prepare, rice was replaced with macaroni and cheese. The rest of the menu items have remained the same. In addition, between-meal supplements have been developed.

Although the results of the aforementioned study indicate general acceptance of the advanced liquid diet products produced

by FED, a study was required to determine the acceptance of commercially produced versions of the new menu items by patients with jaw injuries and dental problems. In addition, a systematic study involving a direct comparison of the new, commercially produced liquid diet with the current diet by both patients and dietitians was necessary.

In the evaluation presented here, the liquid diet products and between-meal supplements were evaluated by patients in terms of overall acceptability, flavor, consistency, texture, ease of sipping, portion size, and variety. Factors such as preparation time and ease of preparation were evaluated by dietitians. Consumption data were collected, and subjects' nutrient intake was compared with the Recommended Dietary Allowances (RDA)[6] to determine the diet's nutritional adequacy.

METHOD

Subjects

Subjects were 96 patients (71 men and 25 women) in military hospitals who were consuming an advanced liquid diet during their hospital stay. Male subjects weighed an average (± standard error) of 168 (± 3) pounds and were 69.5 (± 0.4) inches tall, female subjects weighed 139 (± 5) pounds and were 64.5 (± 0.4) inches tall. The average age of male subjects was 24 (± 0.9) years; females were 28 (± 2) years old. Participants were consuming a liquid diet because they could not consume solid foods as a result of a dental procedure or oral surgery (n = 34), because of a jaw injury (n = 54), or for other reasons such as

facial trauma or correction of the jaw structure (n = 6). The majority of men were on a liquid diet because of a jaw injury; the majority of women were on the diet because of a dental procedure or surgery. Patients who were consuming a liquid diet for other reasons (for example, cancer patients, patients with endocrinologic disorders) were not included in the study. Males had been receiving an advanced liquid diet for a mean of 11 (± 2) days before beginning the evaluation and expected to be on the diet for an average of an additional 30 (± 2) days. Females had been consuming an advanced liquid diet for an average of 4 days (± 1) prior to beginning the evaluation, and expected to be on a liquid diet for 21 (± 4) more days.

General Procedure

The study was a triservice evaluation, conducted at eight military hospitals: Wilford Hall USAF Medical Center, San Antonio, TX; Malcolm Grow USAF Medical Center, Andrews Air Force Base, MD; Bethesda Naval Hospital, Bethesda, MD; Madigan Army Medical Center, Tacoma, WA; Darnall Army Community Hospital, Fort Hood, TX; Womack Army Hospital, Fort Bragg, NC; The 97th General Hospital, Frankfurt, W. Germany; The 121st Evacuation Hospital, Seoul, Korea. These military hospitals were contacted by the Army Office of The Surgeon General before the evaluation period for an initial briefing about the study and its purpose.

Because the Natick investigators were not able to be at each hospital to collect data, hospitals participating in the evaluation were asked to provide support from dietitians, diet technicians, and food service personnel to carry out the study.

All hospitals received a package of test materials which included the commercial liquid diet products (which will be referred to as the "new" products in this report), questionnaires, cups and lids, a calendar that listed the menu schedule, a detailed instruction guide, and a briefing video. The video outlined the test procedures.

Initially, eligible subjects were identified -- patients who were consuming an advanced liquid diet because of a jaw injury or who had undergone oral surgery. Dietitians worked with oral surgeons to determine potential candidates. After obtaining the consent of the patient's physician, the dietitian briefed the patient about the details of the study and asked him/her to volunteer. Each participant filled out a Volunteer Agreement Form (Appendix C) and, for each subject, the dietitian completed a Patient Information Form (Appendix D), which included demographic information as well as details about the patient's hospitalization and health.

The patient's evaluation period began as soon as it was feasible and continued for four consecutive days. On alternating days, the patient was served the new diet or the hospital's current liquid diet. Each hospital was provided with a calendar that listed the menu and diet to be served on each day (see Appendix E for an example). This procedure resulted in a random assignment of subjects to either the new or current diet condition on their first day of the evaluation; some patients began the study on the new diet and some began on the current diet because patients were naturally admitted to the hospital on different days. This method of scheduling also facilitated preparation

because regardless of the number of patients participating on any given day, the same menu was prepared for each subject, whether it was his/her first, second, third, or fourth day on the study.

A Natick representative monitored the study by contacting hospital representatives on a regular basis to answer any methodological questions they had and to determine the number of subjects who had completed the evaluation. A majority of the hospitals were also visited at some time during the evaluation period, so that the procedures could be observed firsthand at individual hospitals. These visits allowed for contact with the hospital staff involved in the various aspects of the evaluation, i.e., the dietitians, diet technicians, diet aides, and food service personnel. In addition, in several cases, individual interviews were held with patients. By meeting with the hospital staff and with patients, the Natick representatives were able to receive valuable information, suggestions, and opinions about the liquid diet products as well as about the evaluation process itself.

Questionnaires and Forms

A number of forms and questionnaires were used to measure consumption and to obtain opinions about the acceptability of the liquid products. A checklist was included with the questionnaires sent to each hospital that listed all forms needed to be completed during the evaluation period. Dietitians were instructed to use this checklist to ensure that all necessary forms and questionnaires were filled out.

Hospital personnel were instructed to measure all liquid products both before and after consumption (the volume served and

the volume leftover) in order to obtain a precise record of intake. The dietitian, diet technician, or food service worker was responsible for completing the Dietitian Consumption Record (Appendix F), on which the pre- and postvolume of each meal item was recorded. These were filled out three times a day, before and after each meal.

Patients filled out two forms at each meal: a Patient Consumption Record (Appendix G) and a Patient Questionnaire (Appendix H). On the Patient Consumption Record, the patient estimated how much of each serving of each product he/she consumed. The purpose of having the dietitian measure consumption and the patient estimate consumption was to determine how well patients can actually estimate how much they drink. If the patients' estimates were found to correlate highly with the actual measurements, then in future studies patients could estimate their intake, and the time-consuming process of the dietitians measuring intake could be eliminated.

On the Patient Questionnaire (Appendix H), the patient used 9-point scales to rate each liquid product on the following acceptability factors: appearance, flavor, consistency, texture, ease of sipping, portion size, and overall acceptability. The questionnaire also included scales for patients to rate their opinions regarding the amount of variety in the diet, meal size, and overall satisfaction with the meals. Hunger during the day was measured, as well as feelings of mood and pain. (See Table 1 for a description of the rating scales included on the Patient Questionnaire.)

TABLE 1.

Description of Rating Scales -- Patient Questionnaire.

Factor	Low Point	Neutral or Mid-Point	High Point
Appearance	Extremely Unattractive	Neutral	Extremely Attractive
Flavor	Poor	Neutral	Excellent
Consistency	Extremely Lumpy	Moderately Lumpy	Not Lumpy (Smooth)
Texture	Extremely Gritty	Moderately Gritty	Not Gritty
Ease of Sipping	Extremely Difficult	Neither Easy Nor Difficult	Extremely Easy
Portion Size	Much Too Small	Just Right	Much Too Large
Overall Acceptability	Dislike Extremely	Neither Like Nor Dislike	Like Extremely
Variety	Poor Variety		Excellent Variety
Meal Size	Much Too Small	Just Right	Much Too Large
Overall Satisfaction	Extremely Dissatisfied	Neutral	Extremely Satisfied
Hunger	Never		Always
Mood	Poor	Average	Excellent
Pain	Very Mild Pain	Moderate Pain	Very Extreme Pain

The dietitians and/or diet technicians were responsible for administering the questionnaires, that is, distributing, explaining and collecting them from patients before and after each meal, and checking questionnaires over for completeness. The new diet questionnaires listed the menu items; dietitians wrote in additional beverages. The dietitians wrote in all the daily menu items on the current diet questionnaires and forms because individual hospital menus could not be determined in advance.

Upon completion of the evaluation, dietitians and other hospital personnel who had been involved in the study were asked to fill out a Dietitian Questionnaire (Appendix I), which included questions concerning preparation of the current liquid diet, issues such as ease of preparation, time requirements for preparation, and variety of the new and current diets, advantages and disadvantages of the two diets, perceptions of patient satisfaction with the new products, as well as recommendations and suggestions for improvement of the new products. (See Table 2 for a description of the rating scales included on the Dietitian Questionnaire.)

Food Preparation

The current diet products were prepared in their usual manner. For the new products, instructions for preparation were written on each packet. All new products were mixed in a blender with eight ounces of hot or cold water, depending on the product's appropriate serving temperature. Although milk can be used instead of water to prepare some of the meal items, for the

TABLE 2.

Description of Rating Scales -- Dietitian Questionnaire.

Factor	Low Point	Neutral or Mid-Point	High Point
Ease of Preparation	Extremely Difficult	Neither Easy Nor Difficult	Extremely Easy
Time Requirements for Preparation	Poor (preparation takes too much time)	Average	Excellent (preparation takes minimal time)
Variety Between Meals	Poor	Average	Excellent

purposes of this evaluation, only water was used in order to standardize the new diet for all hospitals.

The volumes of all new and current products were measured. After each item was blended, it was poured into a measuring cup and its premeal volume was recorded. When patients were finished with their meals, the food trays were returned to the kitchen and the leftover volume of each item was recorded.

The meals were prepared as close to serving time as possible so that the serving temperature and the consistency of the liquids would be maintained. Logistically, it was not always possible to serve the meals immediately after preparation; for this reason, lids were used to keep the liquids at their optimal serving temperatures.

Food service personnel labeled each liquid diet product. Before serving, they were asked to compare the food labels with the foods listed on the patient questionnaires to ensure that they were the same. Labels were used so that patients could clearly identify the products when filling out the questionnaires.

The six flavors of the new milkshake were served during the two days that the patient was receiving the new diet products; one milkshake was usually served at or between each meal. A regular milkshake or nutritional supplement was served with each current diet meal for purposes of comparison.

Materials

The new liquid diet products were produced by Eden Research Laboratories, Richmond, California. The nutritional supplements (the new milkshakes) were produced by the Food Engineering

Directorate (FED) at Natick. All foods were produced and packaged in accordance with USDA, Department of Commerce, Public Health Service, or Military regulations or specifications. All ingredients were FDA approved, and were produced and packaged in accordance with established and accepted good manufacturing practices. Information on specifications for ingredients, preparation and processing, finished product requirements, quality assurance provisions, and packaging can be obtained from the Food Engineering Directorate at Natick.

RESULTS AND DISCUSSION

New Diet Consumption

Nutrient intake of the new liquid diet was calculated from measurements of volume consumed and information from the new liquid diet nutrient data base supplied by FED. Average daily nutrient and caloric intake of the new diet is summarized in Table 3. Intake is reported separately for males (n = 64) and females (n = 20), since there were large differences in intake between these two groups.

Only subjects for whom complete data were available (those who participated in the evaluation for at least two full days) were included in the intake analysis. If subjects participated for three or four full days (two days on the new diet and one or two days on the current diet), an average of the two new diet days was used to compute their average daily intake.

The Program requirements for the new diet state that the diet provide at least 2500 kilocalories, and meet at least 80% of the

TABLE 3.

Average Daily Nutrient and Caloric Intake of the New Liquid Diet.

Nutrient	Unit	MALES Mean	MALES SD	FEMALES Mean	FEMALES SD
Energy	kcal	3163.08	1123.00	1635.51	1026.48
Protein	g	124.95	44.12	62.30	41.65
Fat	g	116.17	42.50	63.11	40.07
Carbohydrate	g	406.27	153.13	205.10	132.18
Fiber	g	4.27	1.95	2.19	1.49
Calcium	mg	3055.71	1140.04	1511.27	1093.38
Phosphorus	mg	2618.36	920.81	1314.56	886.34
Iron	mg	14.48	5.70	7.73	5.13
Sodium	mg	4120.39	1532.92	2013.81	1371.45
Potassium	mg	6341.21	2233.21	3197.59	2108.45
Magnesium	mg	333.26	133.45	169.08	118.35
Chloride	g	6.78	3.16	3.46	2.62
Zinc	mg	13.53	5.46	6.58	4.59
Vitamin A	mcg	2153.57	1050.97	1103.98	868.88
Ascorbic Acid	mg	148.49	93.85	80.05	58.96
Thiamin	mg	2.04	1.13	1.15	0.96
Riboflavin	mg	4.76	1.74	2.39	1.67
Niacin	mg	22.85	11.73	12.62	9.14
Vitamin B_6	mg	2.17	1.37	1.24	1.14
Folacin	mcg	349.10	227.19	205.92	192.25
Vitamin B_{12}	mcg	6.11	3.81	3.44	3.21
Vitamin E	mg	15.23	7.28	7.88	5.38

Recommended Dietary Allowances[6]. The RDA for males and females and the percent of each nutrient actually consumed from the new diet in the present evaluation are listed in Table 4[6]. Male subjects consumed 3163 kcal, significantly more than the 2500-kilocalorie requirement. For certain nutrients, such as protein, ascorbic acid, riboflavin, calcium, and phosphorus, intake was between two and three times the recommended amounts. The intake of vitamin B_6, Folacin, magnesium, and zinc was just slightly below the RDA (see Table 4)[6].

Average intake for females was 1636 kcal, only about half that of males. Military caloric requirements for females are between two-thirds and three-quarters of male requirements (AR 40-25/ NAVMEDCOMINST 10110.1/ AFR 160-95)[7]. Since the caloric requirement for the liquid diet for males was 2500 kcal, the requirement for females would be approximately 1770 kcal. Females in the present study consumed close to this amount.

Female subjects consumed at least 80% of the RDA for ten of the fifteen nutrients for which there are guidelines. However, they did not consume sufficient quantities of vitamin B6, folacin, magnesium, iron, and zinc. Insufficient intake of these nutrients was the result of low intake, in general, rather than low intake of specific liquids. For example, most of vitamin B6 and folacin in the diet is found in the chocolate and chocolate peppermint pudding. The RDAs for these vitamins were not met because only 31% of the portion of the chocolate pudding and 46% of the chocolate peppermint pudding was consumed. This was typical of the consumption level of female subjects, who, on average, consumed only 36% of the portion of each item they were served.

TABLE 4.

Recommended Daily Dietary Allowances*
and Percent of the RDA Consumed
from the New Liquid Diet.

Nutrient	MALES RDA	MALES % Consumed	FEMALES RDA	FEMALES % Consumed
Protein (g)	56	223	44	142
Vitamin A (mcg RE)	1000	215	800	138
Vitamin E (mg)	10	152	8	99
Ascorbic Acid (mg)	60	247	60	133
Thiamin (mg)	1.5	136	1.1	105
Riboflavin (mg)	1.7	280	1.3	184
Niacin (mg)	19	120	14	90
Vitamin B_6 (mg)	2.2	99	2.0	62
Folacin (mcg)	400	87	400	51
Vitamin B_{12} (mcg)	3.0	204	3.0	115
Calcium (mg)	800	382	800	189
Phosphorus (mg)	800	327	800	164
Magnesium (mg)	350	95	300	56
Iron (mg)	10	145	18	43
Zinc (mg)	15	90	15	44

*SOURCE: National Academy of Sciences, Recommended Dietary Allowances, Washington, D.C.: 1980.

For certain nutrients, such as iron, the whole portion of all the liquids had to be consumed in order to meet the RDA.

To determine how the different meal components contributed to total caloric consumption, energy intake was analyzed by meal component type. Almost the exact same proportion of energy was consumed from the different meal components by males as by females. It was found that about 15% of total energy intake was consumed from entrees, 11% from vegetables and starches, and 15% from desserts. About one-third of total caloric intake was consumed from the nutritional supplements, and the remaining 25% was consumed from other beverages such as milk, juice, and soda. These figures demonstrate the significant amount of calories that the nutritional supplements and additional beverages provide to the liquid diet.

Kendell et al.[6] have reported that following minor surgery, caloric requirements increase 25 to 30% in healthy active adults, while requirements may increase as much as 50 to 60% following major surgery. Additional protein is also needed to assist in the healing process. Although it must be noted that not all subjects in this study underwent major surgery, using these numbers as a general guideline, males appear to have consumed a sufficient amount, while females did not.

One explanation for the difference between males and females in meeting nutritional requirements may be that the two groups generally were on the diet for different reasons. The majority of males were in the hospital because of a jaw injury; the majority of females had undergone a dental procedure. These two conditions may have resulted in differences in feelings of pain and ease of

sipping. Subjects rated how much pain they were in on the Patient Questionnaire. T-test results revealed that female patients reported being in significantly more pain than male patients ($t = 7.11$, $df = 98$, $p<0.001$). This may have contributed to differences in intake.

Another factor that may have affected intake is the amount of nutritional counseling given to the patients. If patients were not aware of the importance of their nutrient intake during their recovery period, some subjects, females in particular, may have considered their time in the hospital to be a good opportunity to lose weight. About 10% of subjects reported that they were trying to lose weight at the time of hospitalization; a greater percentage of these patients were female than male. Emphasizing the importance of adequate nutritional intake during recovery may help to increase patients' consumption during their hospitalization. Alternately, the difference in intake between males and females may be explained by differences in satisfaction with the liquid products. Female subjects were significantly less satisfied with the meals than were males ($t = -4.60$, $p<0.001$).

One possible solution to increasing intake for certain patients would be to prepare the liquids with milk rather than with water. Although the results indicate that average intake of calcium was sufficient for both males and females, preparing the liquids with milk would increase their caloric content. One comment that was made by both patients and dietitians was that there was a large amount of fluid in the new liquid diet.

Preparing some of the items with milk would allow an increase in energy content without adding additional volume.

Comparison of New and Current Diet Intake

Because the menu items which made up the current diet differed to a great extent among hospitals, an accurate measure of nutrient intake for the current diet could not be determined within the time and financial resource limitations of this project. However, hospital personnel did measure the volume of the current products before and after each meal, in order to calculate how much of the current diet was consumed. Therefore, the volume consumed of each diet could be compared. Dietitian measurements revealed that, overall, patients consumed equal amounts of the two diets. On average, patients consumed approximately 61% of the new liquid products that they were served, and 63% of the current liquid products they were served.

The average amount of fluid consumed at each meal for the two diets is summarized in Table 5, and the average amount of each food category consumed can be found in Table 6. It appears that patients generally consumed similar amounts of the two diets at each meal and from each food category. Paired t-tests revealed no significant differences between consumption of the new and current diets. However, these comparisons should not be interpreted to mean that nutrient intake of the two diets was the same. The nutrient composition and caloric density of the current diet is unknown and it may have varied greatly among hospitals.

The Nutrition Support Service of Walter Reed Army Medical Center suggested that a patient should consume 600 to 1000 cc of

TABLE 5.

Average Consumption of Liquids Per Meal (cc).

	MALES				FEMALES			
	New		Current		New		Current	
Meal	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Breakfast	1048.46	331.70	958.79	381.87	511.51	349.26	622.07	314.40
Lunch	1143.14	440.07	1240.63	489.98	656.39	426.40	602.56	387.63
Dinner	1211.93	438.02	1290.61	457.80	684.61	413.78	830.21	453.83

TABLE 6.

Average Consumption of Liquids by Food Category (cc).

	MALES				FEMALES			
	New		Current		New		Current	
Food Category	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Breakfast Foods	149.15	78.36	151.17	96.47	71.11	67.26	83.13	81.26
Lunch and Dinner Entrees	191.79	76.24	195.67	88.49	106.06	76.84	107.65	108.48
Vegetables	86.10	69.10	95.79	80.00	53.18	58.18	51.03	69.92
Starches	160.45	75.97	156.20	90.66	83.09	71.66	74.79	85.83
Milkshakes	214.03	80.46	193.70	101.29	119.22	77.36	138.89	126.91
Puddings	151.73	95.69	167.25	95.33	116.60	88.77	118.33	118.40
Desserts	156.19	102.63	170.21	99.98	36.67	32.90	85.00	66.58
Soup	--	--	168.36	102.82	--	--	86.19	94.77
Fruit	--	--	162.53	79.08	--	--	114.69	105.17

liquid per meal for a total of 3000 to 3500 cc per day. Using these guidelines, male subjects consumed a sufficient quantity of liquid from both the new and the current diets. Female patients, although consuming amounts at the low end of the range, met these guidelines as well.

In a study that investigated gastric capacity in humans[9], the maximum amount of fluid that could be tolerated at one time by normal weight subjects (mean weight = 141 lb) was found to be, on average, 1000 ± 67 mL. In another study[10], stomach capacity of similar weight subjects was found to be approximately 1000 mL as well. In Granstrom and Backman's study[9], the maximum volume was determined when subjects refused further liquid because of nausea or discomfort. Therefore, it would seem that people would not normally consume this maximal amount of fluid.

The point at which subjects felt full was also measured in this study[9]. The volume at which a "satiety-simulating sensation" was reached was 541 ± 44 mL. The amount of fluid consumed by females at one meal in the present hospital study was similar (see Table 5); average weight of subjects in these two studies was also similar. Males in the present study consumed approximately 1100 mL. However, their average weight (168 lb) was significantly higher than females (139 lb); this probably indicates a larger stomach capacity as well.

On average, patients were served 1700 mL of liquid at each meal, significantly more than they consumed at one time. For this reason, it is recommended that the portion size of the liquids in the new diet be reduced from eight ounces to six ounces, if their caloric and nutrient content can be maintained. In the present

study, patients were often served the new milkshake with their meal. It is recommended that these supplements be served between meals rather than with the meal in order to enhance daily consumption.

Patient Estimates of Consumption

In addition to hospital personnel measuring the liquids before and after the meals, patients also estimated how much of each liquid they consumed, for example, 0, 1/4, 1/2, 3/4, or 1 portion (see Appendix G, Patient Consumption Record). Actual measurements were converted from volume to portions so that patient estimates and actual measurements could be directly compared. A correlation analysis revealed that patients' estimates and actual measurements were significantly correlated ($r=0.96$, $p < 0.001$). Correlations were computed separately for each hospital; for each hospital the correlations were also significant ($p < 0.001$).

An analysis was also done to determine how often patient estimates agreed with actual measurements, how often patients overestimated or underestimated the amount consumed, and by how much of a portion they were in error. Results indicate that when estimating consumption of the new diet products, patient estimates were equal to actual measurements 62% of the time (this includes "estimates" of '0' and full portions); patients underestimated 14% of the time and overestimated 24% of the time. When patients underestimated consumption, the mean error was 0.23 of a portion (SD = 0.16); patients overestimated, on average, 0.16 of a portion (SD = 0.18). For current diet items, patient estimates were equal

to actual measurements 77% of the time; patients underestimated 10% of the time (mean error = 0.18 of a portion, SD = 0.19), and overestimated 13% of the time (mean error = 0.17 of a portion, SD = 0.21).

It appears that subjects' estimates of consumption were generally very accurate. In future studies of this nature, patients could estimate their consumption, and thus eliminate the need for food service workers to measure actual volumes.

Acceptability of the Liquid Products - Patients' Opinions

Patients rated the new liquid diet items on appearance, flavor, consistency, texture, ease of sipping, portion size, and overall acceptability (see Patient Questionnaire, Appendix H). Each of these acceptability factors was rated on a 9-point scale. Average ratings for each of these factors for the 26 products in the new liquid diet can be found in Tables J-1 to J-7, Appendix J.

The appearance of all new diet items was rated above the neutral point of the scale (5) with the exception of glazed carrots and peas and carrots (see Table J-1). The milkshakes and puddings received the highest ratings, probably because patients were most accustomed to seeing these items in liquid and semi-liquid form, respectively.

Ratings of flavor of the new liquids ranged from neutral to excellent (see Table J-2). The puddings and milkshakes were rated highest, along with the meat products, such as turkey and gravy, beef and gravy, and chili. Again, the carrot items were rated lowest; the breakfast items were rated somewhat lower than the lunch and dinner items.

On the consistency scale, all new products were rated between slightly lumpy and smooth. The cauliflower, carrots, mashed potatoes, grits, and chocolate pudding were perceived as being somewhat lumpy. The milkshakes had the smoothest consistency.

Ratings of texture for the new products ranged from 6.68 to 8.21 (see Table J-4); the average rating corresponded to less than "slightly gritty" on the category scale. The milkshakes were rated as being the least gritty of the items. The grits and cauliflower were rated as being slightly gritty. Although blenderized meats are often gritty, the new liquid meat products were not rated as such.

All new liquids were rated above the neutral point on the ease-of-sipping scale. The milkshakes were rated as easiest to sip; the carrots, mashed potatoes, cauliflower, French toast, and the puddings were rated as slightly less easy to sip.

Several patients commented about the consistency of the new products on the questionnaires. A number of patients commented that the puddings were too thick, especially the chocolate pudding. Some patients were very limited in their facial and jaw movement and found it painful to sip the liquids; these patients felt that many of the new liquids were too thick. However, other patients who had a greater degree of jaw mobility would have liked even thicker products.

On average, the portion size of the new liquids was rated between just the right size and somewhat too large. Generally, the products that were liked the least (for example, peas and carrots and glazed carrots) were rated as being too large. Some of the sweeter products were also rated as being somewhat too

large (for example, apple pie, chocolate pudding, and eggnog milkshake). These results seem consistent with patients' ratings of how hungry they felt during the day. The majority of patients generally felt hungry "never", "almost never", or "some of the time" while consuming the new and current diets, although subjects felt slightly more hungry while consuming the current diet. Many patients commented that they felt too full to finish their meals when consuming the new diet.

The overall acceptability of the individual new liquid products is summarized in Table 7. The beef products and certain puddings and milkshakes received the highest ratings. The breakfast items were only liked slightly. The carrots and sweet potatoes received neutral ratings. None of the products were disliked overall, with the exception of peas and carrots. The orange- and eggnog-flavored milkshakes, on average, were liked slightly less than the traditional milkshake flavors.

Since the range of current liquids served at the eight hospitals during the evaluation was extremely broad, the various acceptability factors for the current diet were calculated by food category (breakfast foods, lunch and dinner entrees, starches, etc.). Tables with means and standard deviations of acceptability ratings of food categories for both the new and current diet can be found in Tables K-1 to K-7 in Appendix K. Paired t-tests were done (for food categories in which the number of ratings was at least fifteen) to determine if there were any differences in average ratings of the various acceptability factors between the two diets. These results are illustrated in Figures 1-7. (The

TABLE 7.

Overall Acceptability of the New Liquid Diet Products.*

	Mean	Std Dev
Turkey and Gravy	7.27	1.84
Chili	7.21	1.71
Chocolate Milkshake	7.14	1.48
Beef and Gravy	7.09	1.71
Vanilla Pudding	6.93	1.92
Banana Milkshake	6.86	1.96
Strawberry Milkshake	6.86	2.03
Chocolate Pudding	6.84	1.90
Vanilla Milkshake	6.80	1.97
Macaroni and Cheese	6.76	2.22
Chocolate Peppermint Pudding	6.76	2.04
Apple Pie	6.60	1.97
Buttered Corn	6.58	2.06
Spaghetti with Beef	6.55	2.17
Noodles Parmesan	6.52	2.18
Eggnog Milkshake	6.50	2.37
Orange Milkshake	6.20	2.27
Mashed Potatoes	6.17	2.14
French Toast	5.94	2.32
Farina Cereal	5.94	2.15
Cauliflower au Gratin	5.93	2.07
Cheese Omelet	5.58	2.27
Grits	5.42	2.58
Sweet Potatoes	5.07	2.21
Glazed Carrots	4.94	2.45
Peas and Carrots	4.48	2.82

*1=Dislike Extremely...9=Like Extremely

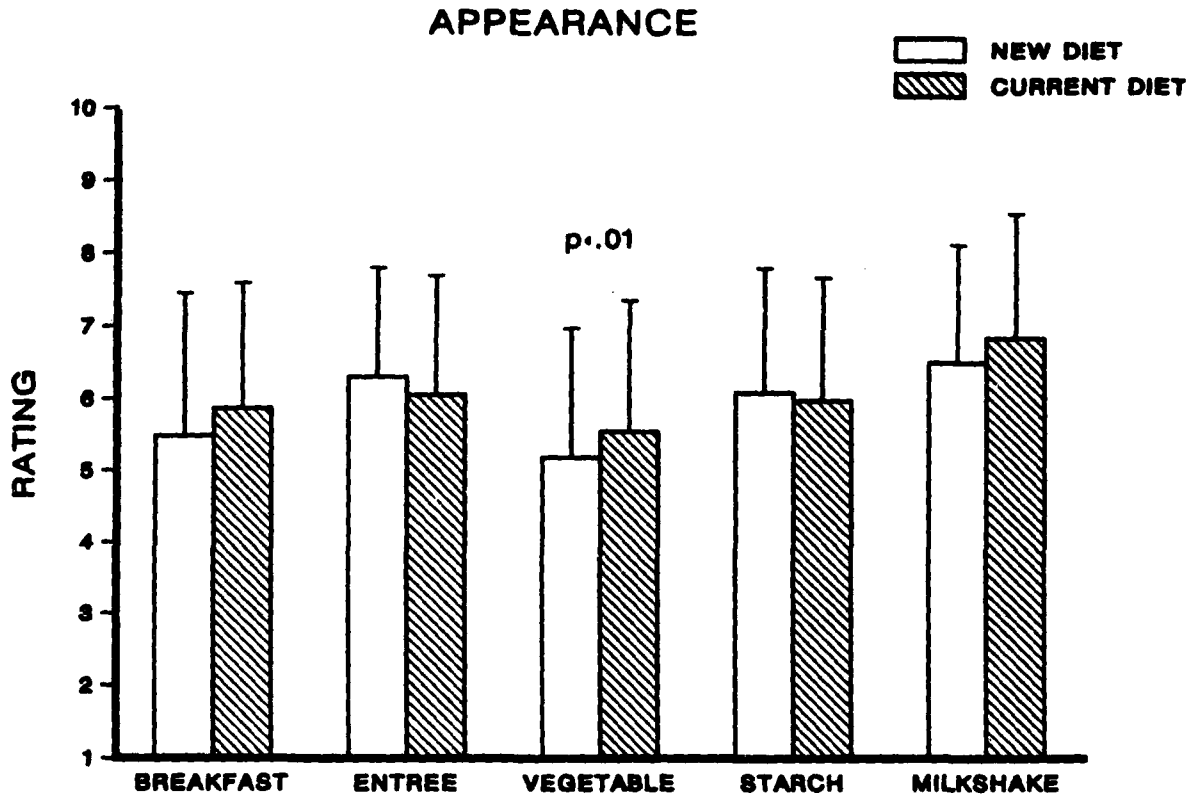

Figure 1. Diet Comparisons: Appearance.

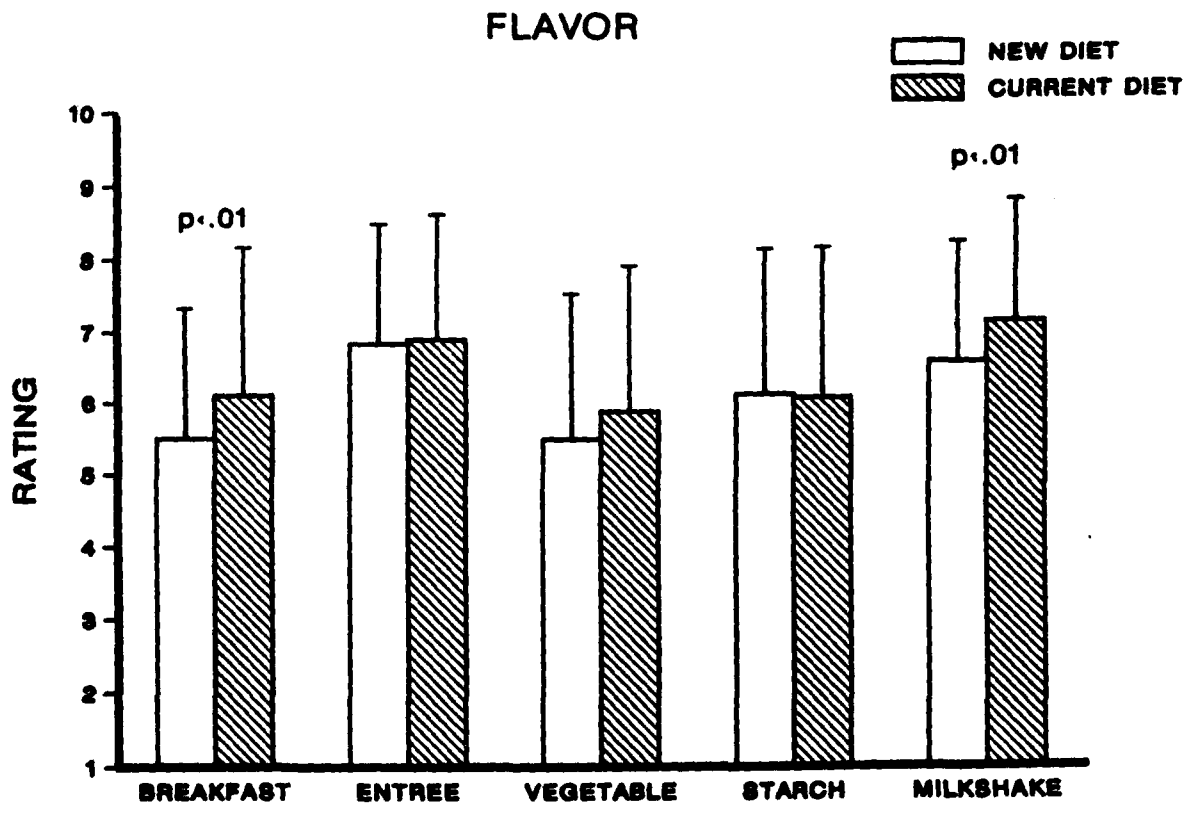

Figure 2. Diet Comparisons: Flavor.

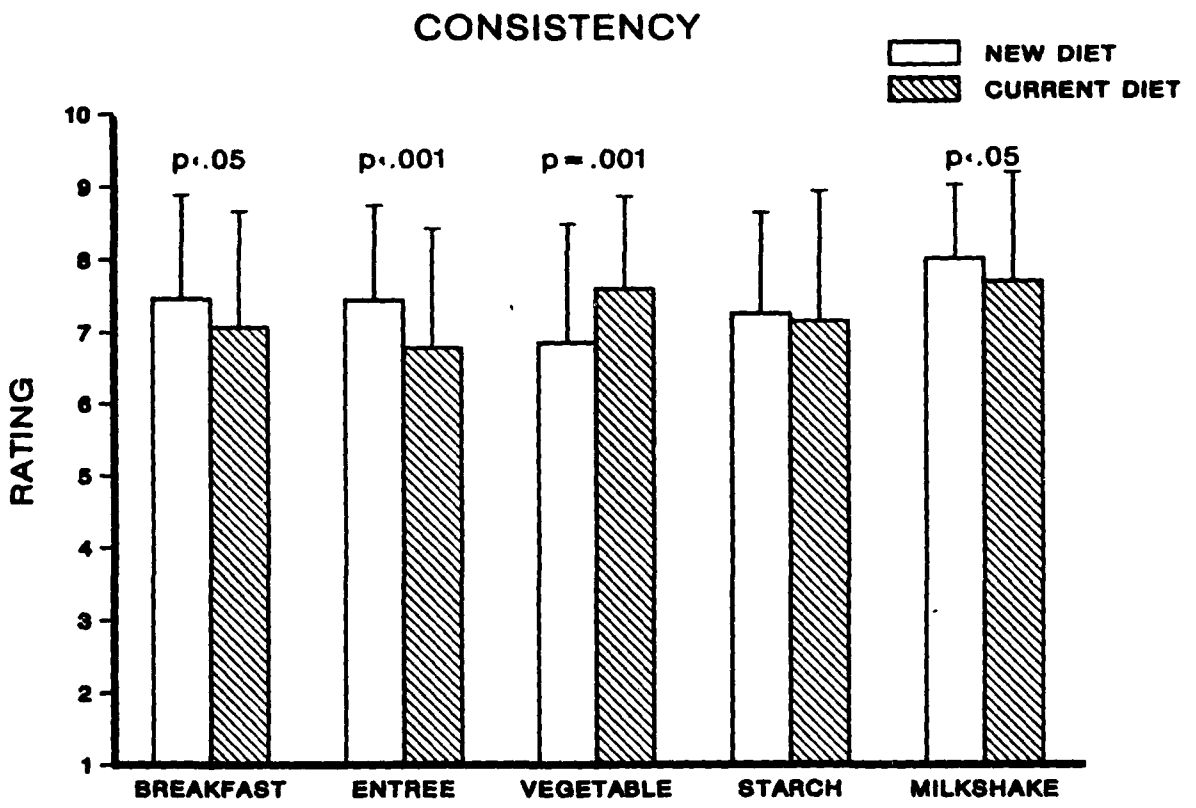

Figure 3. Diet Comparisons: Consistency.

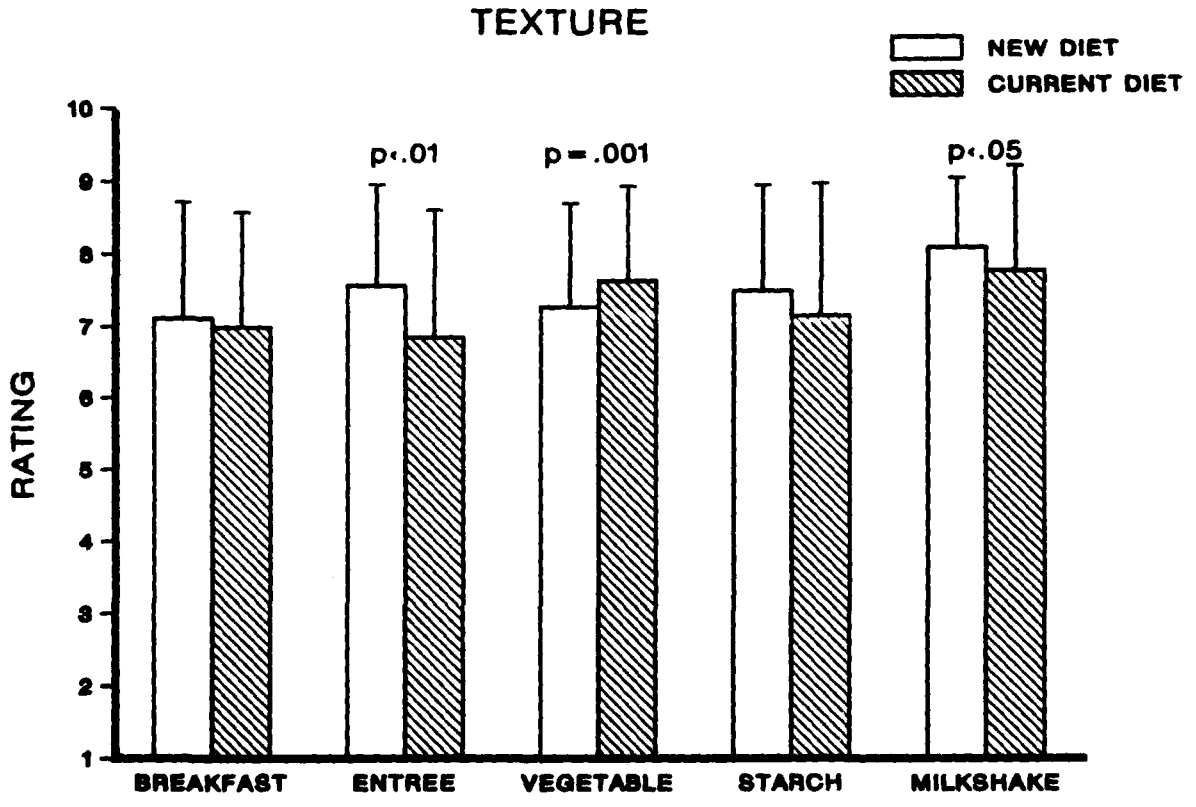

Figure 4. Diet Comparisons: Texture.

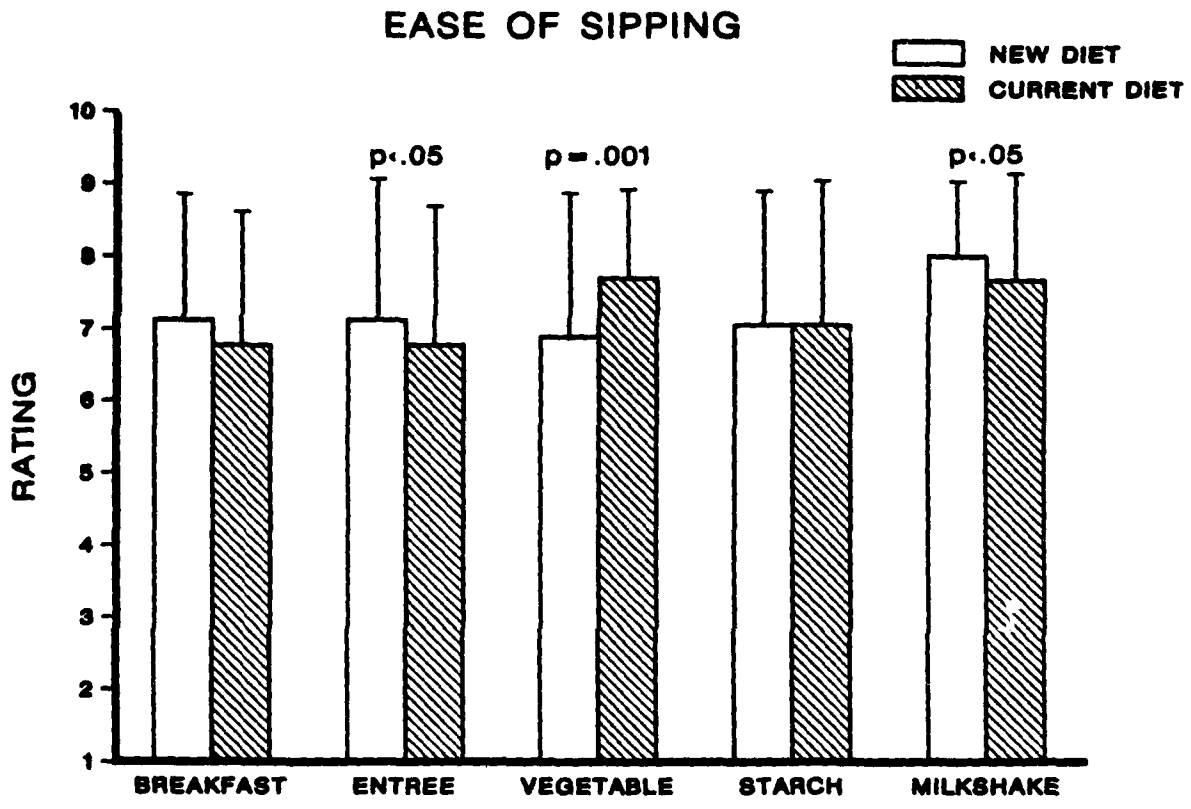

Figure 5. Diet Comparisons: Ease of Sipping.

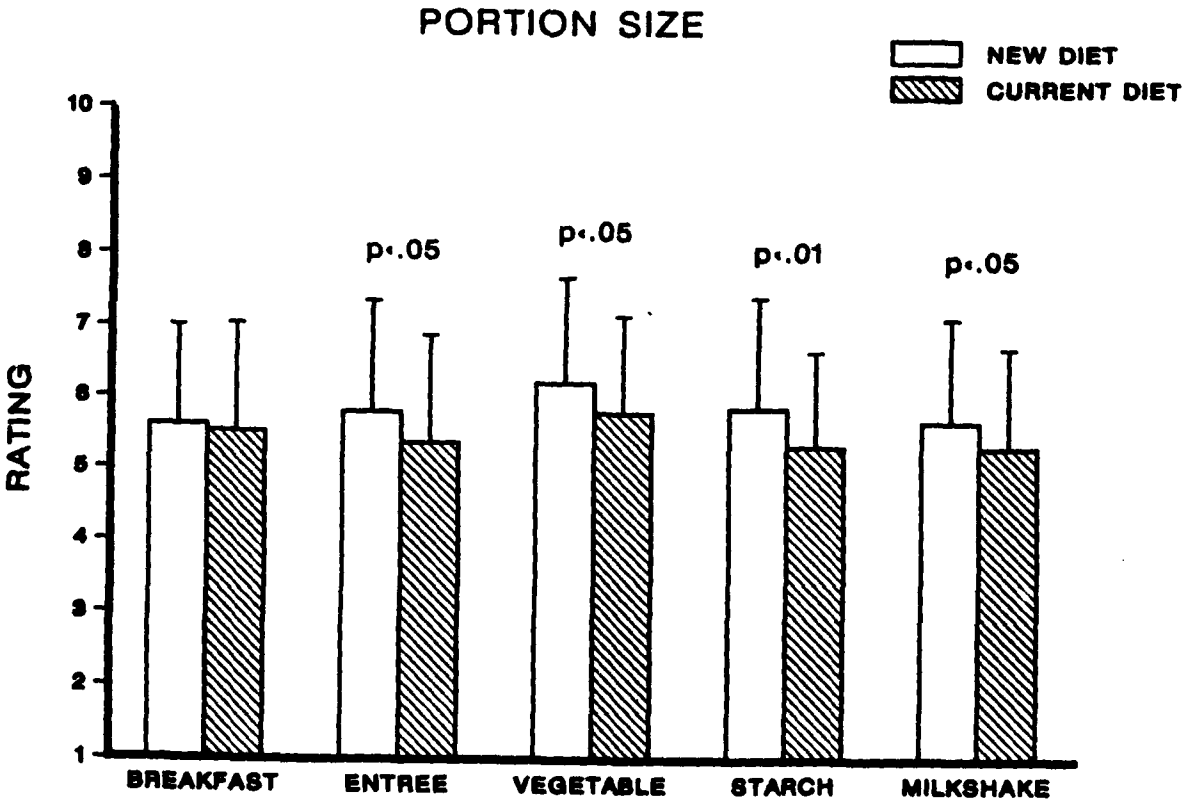

Figure 6. Diet Comparisons: Portion Size.

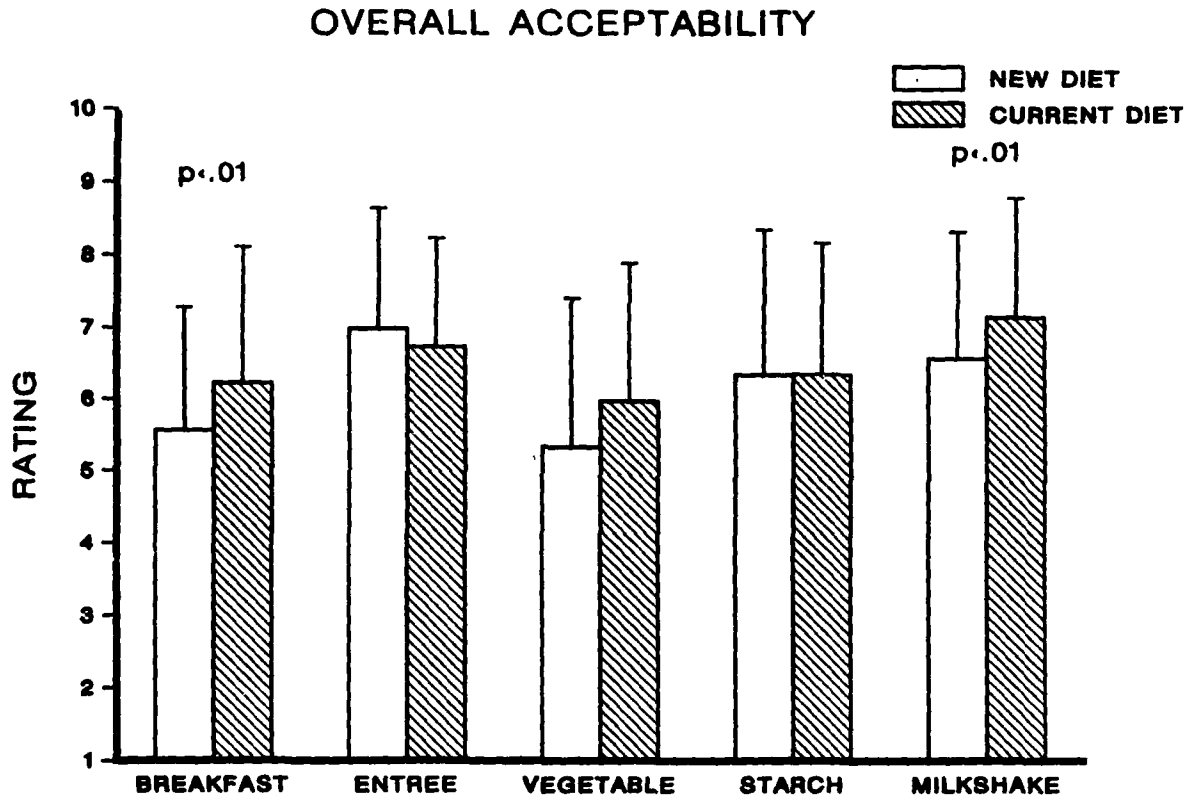

Figure 7. Diet Comparisons: Overall Acceptability

means that were compared in the paired t-tests may be slightly different than the overall means reported in Appendix K. If a subject did not rate any foods in a certain food category for either the new or current diet, his/her ratings were dropped from the t-test analysis for that food category.)

The new entrees were rated as being significantly smoother, less gritty, and easier to sip than the current entrees ($t=4.49$, $df=80$, $p<0.001$; $t=3.24$, $df=79$, $p=<0.01$; $t=2.41$, $df=79$, $p<0.05$, respectively) (see Figures 3-5). The current vegetables were rated as being significantly more appealing in appearance, smoother, less gritty, and easier to sip than the new vegetables ($t=-2.86$, $df=65$, $p<0.01$; $t=-3.45$, $df=64$, $p=0.001$; $t=-3.45$, $df=61$, $p=0.001$; $t=-3.46$, $df=62$, $p=0.001$, respectively). Note that the current "vegetables" food category included vegetable soups. The other current soups were included in the "soups" food category; these additional soups also received high ratings on the various acceptability factors. The new liquid diet tested in the present evaluation did not include soups. For future development, it might be beneficial to develop soups to replace some of the less appealing vegetables, or to at least call these products soups.

The portion size of several of the meal components was rated as being "slightly too large" for the new diet while the current diet was rated as being "just the right size" (see Figure 6). For products that are developed in the future, it would be beneficial to reduce the portion size of the liquids somewhat while maintaining their nutrient composition.

The overall acceptability of the breakfast foods and the milkshakes was rated significantly higher for the current diet

than the new diet ($t=-3.07$, $df=75$, $p<0.01$; $t=-3.24$, $df=81$, $p<0.01$, respectively) (see Figure 7). It must be noted that the new "shakes" are nutritional supplements (more like Ensure* than ice cream shakes). The current milkshakes to which they were being compared included regular milkshakes and ice cream shakes. This probably accounted for the higher ratings of the current milkshakes.

Some of the same individual foods that make up the new diet menus were also served as part of the current diet. Acceptability ratings for similar items were compared for those products where the number of ratings was at least fifteen. There were significant differences for various acceptability factors for several items, namely, turkey, beef, potatoes, and the vanilla milkshake (see Table L-1, Appendix L).

The texture of the new turkey and beef products was rated as being significantly less gritty than the current meat products ($t=2.96$, $p<0.01$). The new liquid beef was also found to be less lumpy and less gritty than the current beef products ($t=2.30$, $p<0.05$; $t=2.52$, $p<0.05$, respectively). The current liquified potatoes were rated as easier to sip than the new potatoes ($t=-2.29$, $p<0.05$). The current vanilla milkshake (which included regular and ice cream milkshakes) was rated as more acceptable than the new vanilla milkshake on appearance ($t=-2.98$, $p<0.01$), flavor ($t=-4.89$, $p<0.001$), consistency ($t=-2.80$, $p<0.01$), and overall acceptability ($t=-4.03$, $p<0.001$). It must be noted that some of these comparisons were made between products that were not exactly the same. For example, the acceptability ratings of the

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*Ensure is a product of Ross Laboratories, Columbus, Ohio.

current potatoes included ratings of any type of potatoes served at any of the hospitals versus the one potato product included in the new diet.

Subjects were generally satisfied with the new and current meals overall. Most subjects rated their overall satisfaction with the new and current meals as '5' or higher. Subjects also felt that the overall variety of both diets was good. In general, there were no differences in overall acceptance of the new and current diets.

Variety, meal size and overall satisfaction were analyzed by individual menu for the new diet, and by meal (breakfast, lunch and dinner) for the current diet. The results are summarized in Tables M1-M3 in Appendix M. Using analysis of variance and post-hoc tests (Student Newman Keuls), it was found that ratings of variety of the breakfast meal were significantly lower ($F=8.78$, $p<0.05$) than variety during lunch and dinner. Subjects also felt that the meal size of the new diet breakfasts was significantly smaller than the size of the new lunch and dinner meals ($F=4.28$, $p<0.05$). A number of subjects commented that the breakfast was too small and the other meals were somewhat large. These findings are not surprising, since the breakfast meal has fewer items and fewer choices of items than the other meals.

Patients were in fairly good spirits during the study. About 70% of patients rated their mood above average on new days, 65% of patients did so on current days. Most patients did not report being in a great deal of pain during the study. The majority of patients reported feeling mild pain, very mild pain, or no pain (see Table M4, Appendix M).

Subjects had a number of positive things to say about the new diet as was indicated in interviews and by comments on questionnaires. The patients generally liked the new products. They felt the liquids tasted good, especially lunch and dinner, had good variety, and were better than the current diet.

Patients indicated that several of the new diet products were not fully acceptable. The grits, peas and carrots, glazed carrots, sweet potatoes, farina cereal, cheese omelet, and cauliflower seemed to be the least popular items. Subjects thought the carrot items looked and smelled unappealing. The grits and the farina cereal tasted bland.

One patient felt that by serving the whole meal at one time, he tended to drink the sweet, familiar tasting liquids, such as the milkshakes, first, rather than tasting or filling up on the less appealing entrees or vegetables. However, others mentioned that some of the desserts and milkshakes were too rich and too sweet. Some patients felt that the milkshakes did not always go with the meal served. If the nutritional supplements were part of the hospital menu, the flavor of the supplement to be served should be planned with the rest of the meal.

Patients also made several suggestions about ways in which to improve the new diet. Many suggested adding condiments, such as salt and pepper, hot sauce, sugar and butter (for the grits) and syrup (for the French toast). Several patients mentioned that the meals were served too close together in time, particularly given the large amount of fluid that was served at each meal. (The timing of meals probably differed by hospital.) Subjects also suggested that additional types of liquids be added to the new

diet such as more meats, soups, more breakfast foods, and larger breakfast meals. Others commented that something other than milkshakes be served as snacks, such as fruit.

Although there were not as many positive comments about the meals overall for the current diet as were reported for the new diet, patients did mention that they were satisfied with the current meals. A number of subjects commented positively about the flavor of the current meat products. The current milkshakes that were made with ice cream were especially well-liked.

Subjects did have some criticisms of the current diet. Patients commented that there was not enough variety in the breakfast meal. They also commented that certain items were too thick or lumpy to sip through a straw, while other items were too runny and tasted bland and watered-down. It was also mentioned that the same item was not always consistent from day to day. The consistency of the meat was not always acceptable. Some of the current diet meats were hard to sip, somewhat stringy, and sometimes got caught between the teeth or in the wires. The ice cream shakes were sometimes too thick to sip through a straw.

Although both the new and current diets were well-accepted overall, when patients were asked to explain the reasons for not finishing their whole meal, for both the new and current diets, the most common response was that they did not like some of the foods that were served. Other common reasons subjects gave for not finishing the new diet were: they lacked a good appetite, the portions were too large or they were too full to drink everything, the consistency or texture was not acceptable, the product(s) were too bland, the temperature was inappropriate (the entrees were

cold or the milkshakes and/or puddings were warm), they were not feeling well or their jaw was sore. Similar responses were given for the current diet, although patients seemed to be more dissatisfied with the consistency (the liquids were too thick or lumpy, or too watery) and flavor of the current diet than the new diet.

Additional comments revealed some general problems experienced by patients. Because subjects had open sores in their mouths, some of the juices, such as tomato, orange, and cranberry, were painful to drink because they were highly acidic. Some patients with wired jaws said that the metal in their mouths made it difficult to drink liquids that were extremely hot or extremely cold. One patient commented that he had to let the liquids cool off before he could drink them; he also said that some of the current milkshakes that were made with ice cream were too cold to drink.

A couple of patients were not aware that "real" foods could be liquified and were pleased to see that there was an acceptable alternative to milkshakes. Several patients also commented that they really liked the soups that were part of the current diet and suggested adding soups to the new liquid diet. Since the liquified vegetables are very similar to soup, it may be beneficial to call these items soups rather than liquid vegetables. Some of the new liquid diet products may be more acceptable if they were called soups because soups are normally consumed in liquid form.

Dietitians' Opinions of the New Diet

Dietitians were asked to rate both the new and current products on ease of preparation, time requirements for preparation and variety between meals. The results of ratings of these variables are summarized in Tables 8 to 10.

The results indicate that the new items are easy to prepare, and each of the food categories (e.g., entrees, vegetables, desserts, etc.) was rated as being much easier to prepare than the current products (see Figure 8). It was also found that, with the exception of the milkshakes, the new products were rated as taking significantly less time to prepare than the current products (see Figure 9). Dietitians estimated that it took twice as long to prepare the current liquid diet (mean = 36.1 minutes, excluding the initial cooking time) than it did to prepare the new diet (mean = 19.5 minutes). Preparation time for both the new and current diets may be slightly inflated because the volume of each individual item had to be measured before it was served.

The new diet seemed to have more of a variety of starches and milkshakes than the current diet, although none of the differences in ratings of variety between the two diets were statistically significant (see Figure 10). While the new diet evaluated in the present study was only a two-day menu, with 20 items and six milkshakes, the five-day liquid diet currently in development (July 1988) will include 50 different menu items and six milkshake flavors. The five-day menu will have considerably more variety than the new diet evaluated in the present study.

The standardization of the new liquid products was also cited as a major advantage in comparison to the current products because

TABLE 8.

Ease of Preparation.*

	New		Current		T-Test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Entree	8.54	0.52	4.23	1.88	-8.43	12	p<0.001
Starch	8.54	0.52	5.69	2.10	-4.94	12	p<0.001
Vegetable	8.54	0.52	5.15	2.15	-5.92	12	p<0.001
Dessert	8.54	0.52	6.38	1.45	-5.11	12	p<0.001
Milkshake	8.54	0.52	7.69	1.38	-2.27	12	p<0.05

*1=Extremely Difficult...9=Extremely Easy

TABLE 9.

Time Requirements for Preparation.*

	New		Current		T-Test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Entree	7.62	1.45	3.85	2.08	-6.17	12	p<0.001
Starch	7.62	1.45	5.00	1.91	-4.76	12	p<0.001
Vegetable	7.62	1.45	4.92	1.75	-4.82	12	p<0.001
Dessert	7.38	1.61	5.62	1.98	-2.71	12	p<0.05
Milkshake	7.38	1.61	6.92	1.89			NS

*1=Poor (preparation takes too much time)...9=Excellent (preparation takes minimal time)

TABLE 10.

Variety Between Meals.*

	New		Current		T-Test Results
	Mean	Std Dev	Mean	Std Dev	
Entree	6.00	2.08	6.54	1.90	NS
Starch	6.15	2.19	4.31	2.87	NS
Vegetable	5.92	2.02	5.85	2.34	NS
Dessert	6.46	2.30	6.00	2.00	NS
Milkshake	7.00	1.78	4.92	2.60	NS

*1=Poor...9=Excellent

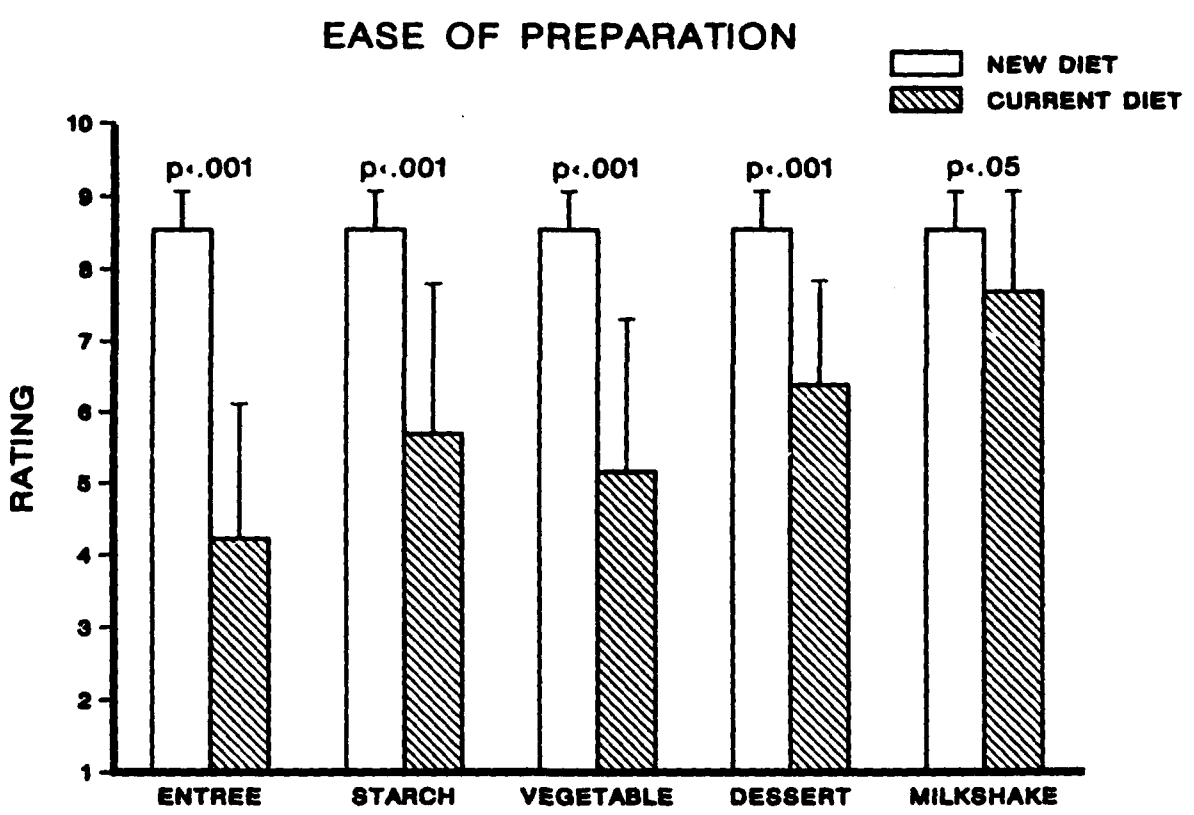

Figure 8. Diet Comparisons: Ease of Preparation.

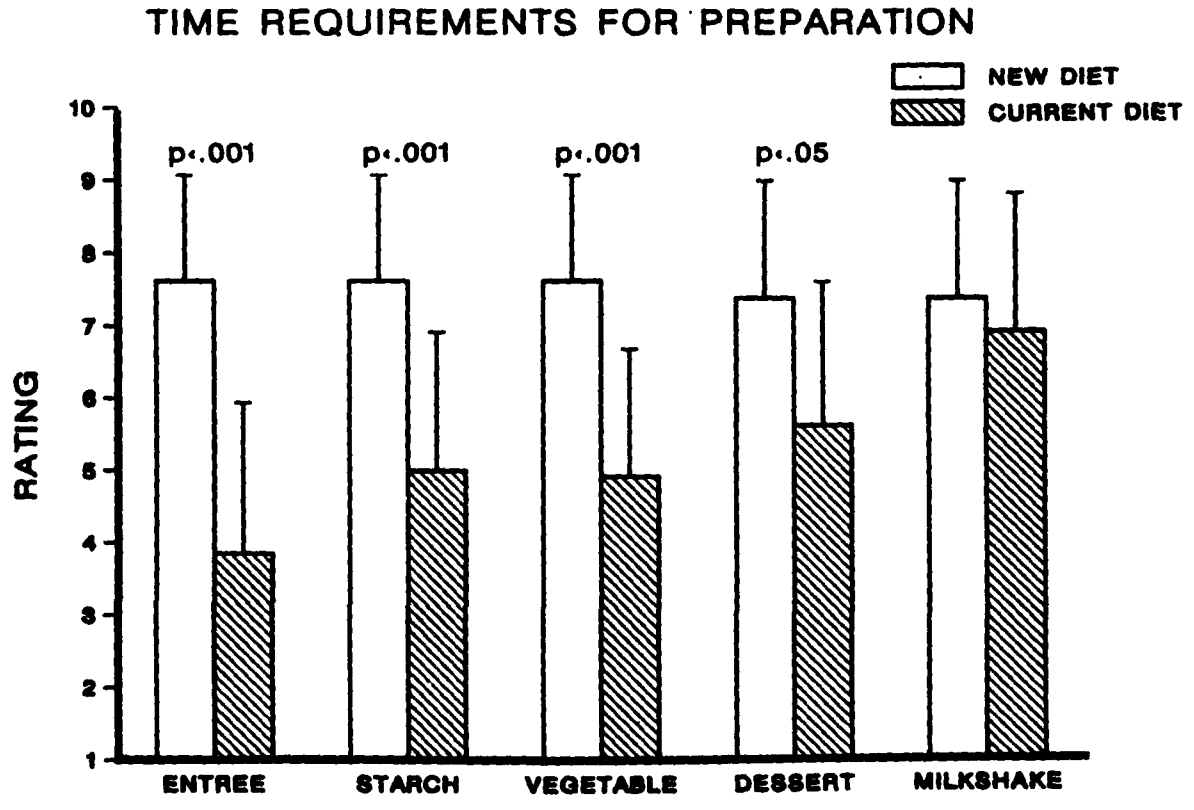

Figure 9. Diet Comparisons: Time Requirements for Preparation.

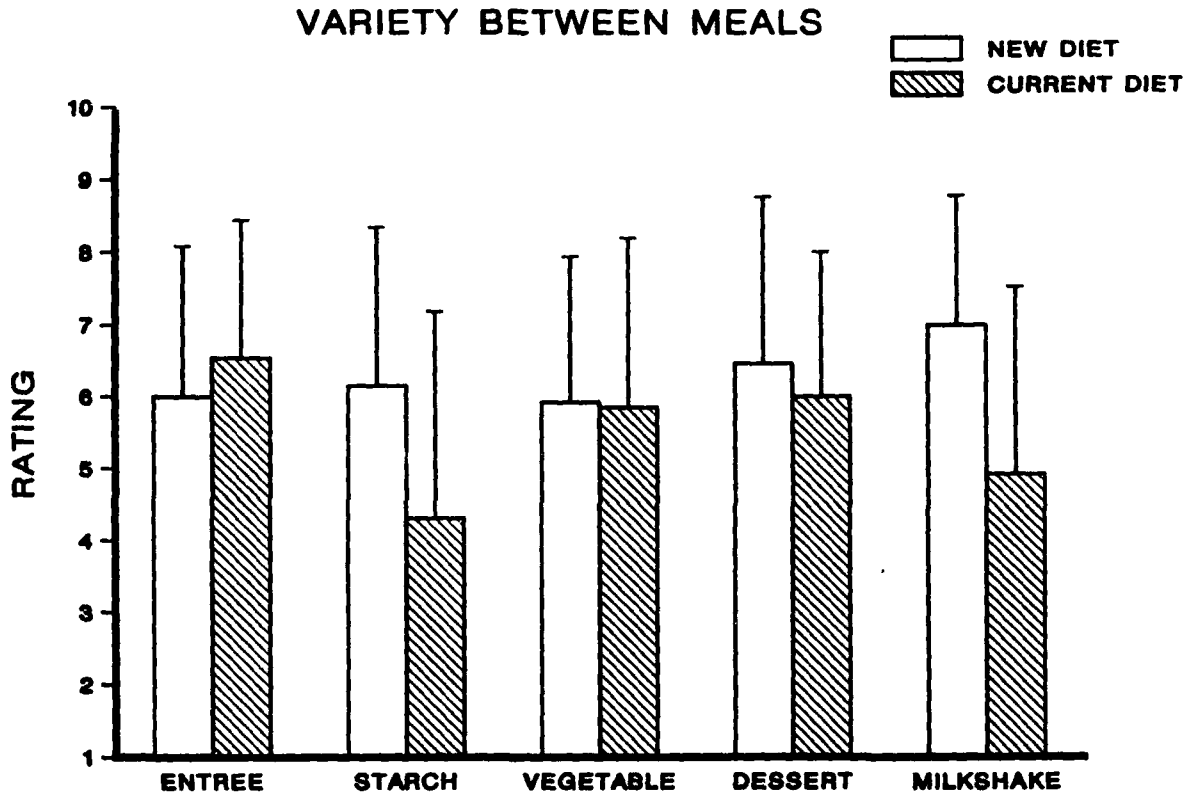

Figure 10. **Diet Comparisons: Variety Between Meals.**

the nutritional adequacy of the menus is ensured. Another major advantage of the new diet that was mentioned by several dietitians was that its method of preparation is much more sanitary than preparation of the current diet. Since the new diet only has to be blended and poured into a cup, it can be prepared very quickly just prior to serving. The foods for the current diet, on the other hand, have to be cooked first, mixed in a blender, and then strained before they can be poured and served. These steps of preparation are not always performed continuously. The foods are sometimes left out in the open air for significant periods of time during preparation, increasing the likelihood of contamination.

Other positive aspects of the new diet that were mentioned by dietitians at the various hospitals include its texture and consistency, the variety of the diet, the high quality of the products, and their minimal storage requirements. The long shelf life of the new products is an advantage for use in a hospital setting, especially for those hospitals who have few liquid diet patients and do not always know how much of the product they may need at any particular time. Several dietitians also commented that since the diet is so easy to prepare, the chance of making mistakes during preparation is reduced. The ease of preparation is also an advantage for use in home settings, for patients who may use the products after they are discharged from the hospital. Another advantage is that less equipment is needed for preparation of the new products compared to the current products. Other positive characteristics mentioned by dietitians were that the new liquids look appetizing and have a pleasant odor.

One dietitian was concerned about the high fat content of the new diet (40%), which could be even higher if the products are prepared with milk instead of water. Although the consistency of the liquids was found to be satisfactory, particularly compared to some of the current products, a few dietitians mentioned that certain liquids thickened upon standing, such as the puddings, while others tended to separate, such as the French toast and the noodles parmesan.

Dietitians reported that one of the major difficulties in serving the liquid diet was maintaining the liquids at their appropriate temperature. In some hospitals, it was not always possible to deliver the meals immediately following preparation. Once this problem was identified during the study, plastic lids were used to keep the products warm. Measuring the liquids before they were served may have contributed to the liquids cooling before the patients received them. If the temperature of the liquids continues to be a problem after measuring the volume is eliminated from the preparation procedure, this problem should be addressed. Perhaps an insulated serving container could be developed if necessary.

One hospital mentioned that the cost of the new diet was a disadvantage. Since the products tested in the present evaluation were freeze-dried, they were relatively expensive in comparison to the current products. However, the significant savings in preparation time using the new diet would result in consequent savings in labor costs. In addition, the five-day menu currently under development will consist of dry blended products which are significantly less costly than freeze-dried products. For

example, the average cost of a dry blended product is $0.57 versus $0.82 for a freeze-dried product.

Another problem mentioned regarding the new diet was the difficulty in opening some of the packages, especially the milkshake packages. The packets of the meal components had tear notches which made for easy opening; however, some of the milkshake packets lacked this feature. The new items currently being produced will include this feature for all products.

Some hospitals had only a small number of liquid diet patients throughout the evaluation period, while other hospitals admitted several patients each week who required liquid diets. The individual packaging of meal components was very convenient when the diet only had to be prepared for one patient. However, it proved to be a disadvantage when the new diet needed to be prepared for several patients at one time because preparation became significantly more time-consuming. It was suggested that multiple servings be available for five patients or more for hospitals in which there are large numbers of dental liquid diet patients. It was also suggested that bulk packages would be more useful in wartime.

One of the hospitals had a problem with the preparation of the new diet because only an industrial-size blender was available for mixing. It was especially difficult to mix adequately one portion in such a large blender. The dietitians at this hospital recommended the development of liquid products that would not need a blender, but instead could be mixed by hand. This would also be more practical for use of the liquid diet in the field. The products that are currently being developed can be mixed by hand.

Dietitians were asked to comment on their perceptions of patient satisfaction with the new diet. Patients appeared to be satisfied with the taste and appearance of most products. Some did not seem to enjoy the breakfast meals as much as the lunches and dinners. Several patients indicated that they would have liked to continue on the new diet following the evaluation rather than go back to consuming the current diet. One hospital, at which a relatively small number of patients participated in the evaluation, felt that the patients generally did not like the new products.

Dietitians at several sites felt that the portions of the liquids were too large. These dietitians recommended that serving smaller, more frequent meals might be more practical. On the other hand, other hospitals felt that the portion sizes were just right; some of their patients even requested double portions of the liquids.

Seven out of the eight hospitals surveyed recommended the continued use of the new products and the development of additional ones. Some of the dietitians also mentioned that when they briefed the oral surgeons at their hospitals about the new products, they were very enthusiastic about them. The physicians' opinion was that the new diet would be extremely useful for liquid diet patients. Those who tried the products thought that they were very acceptable.

The major recommendation from the dietitians was to develop a longer and more varied menu. Some dietitians recommended at least a seven-day menu or even a two-week menu. Suggestions for items to be added included: different vegetables, such as broccoli and

green beans; more meats and other entrees like chicken tetrazzini, hamburgers and cheeseburgers, noodle casseroles, lasagna, and pizza; breakfast items such as pancakes, muffins, and oatmeal; applesauce; starches such as escalloped potatoes and ham; desserts like pumpkin pie and butterscotch pudding; and different flavored milkshakes, such as peach, raspberry, pineapple, and chocolate-peanut butter.

A number of suggestions were given concerning ways in which to improve the new diet such as: decreasing the portion size of the products, making the puddings thinner, increasing the fiber content of the diet, developing lactose-free products, including spice packets with the diet, planning the menus better to ensure that the individual components of the meal taste well together, modifying the beef and spaghetti sauce recipe, and making some of the desserts and milkshakes a bit less sweet.

Dietitians' Opinions of the Current Diet

The general process of preparing an advanced liquid diet was similar at all hospitals who participated in the evaluation. Food was cooked as usual, and was then pureed and thinned in a blender with broth, gravy, milk, or juice, depending on the type of food. The liquids were then usually strained and seasoned. When baby foods or dental soft menu items were served, they were also blended with broth or juice until the products were thin enough to sip through a straw. Most hospitals also served commercial liquid products, such as Ensure, and rehydrated commercial products such as Carnation Instant Breakfast.

For the current diet, the main advantages mentioned were its more natural taste and texture and the variety of the diet. Dietitians also reported that the current diet is more economical, and seasoned better than the new products.

According to the dietitians, the major disadvantages of the current diet are the time and equipment required for preparation, and the lack of product standardization. Other disadvantages mentioned include: the difficulty in determining the nutritional value of the products due to the various amounts and types of liquids added during blending; the lack of variety of the starches, desserts, and milkshakes; the difficulty in liquifying certain regular foods; dissatisfaction with the diet by patients; messiness of preparation; separation of the liquids; and the difficulty of using it in the field.

More specifically, because the recipes for the current diet are generally not standardized, it is often difficult to determine the appropriate amount of liquid to add to the blenderized foods to produce a consistency that is acceptable to liquid diet patients, while maintaining the original flavor of the food and keeping the same products consistent from day to day. Foods often turn out to be either too thick or too watery. Meat products are particularly problematic to liquify because they are often too tough to liquify without becoming watered-down. Other products such as rice, noodles, and corn are difficult to strain.

CONCLUSIONS AND RECOMMENDATIONS

Results of the present study indicate that the nutrient and caloric intake of the new diet was sufficient for male patients who participated in the evaluation. Average daily caloric intake was 3163 kilocalories. Intake for all nutrients met at least 80% of the RDA. For certain nutrients, such as protein, ascorbic acid, riboflavin, calcium, and phosphorus, intake was two to three times the RDA.

Female subjects consumed 80% of the RDA for ten of the fifteen nutrients for which there are guidelines. Intake of energy was slightly low. In order for the requirements for some of the other vitamins and minerals to have been met, a majority of the portion of each menu item that was served had to be consumed. Since female patients only consumed an average of 36% of what they were served (only about half that of males), intake of vitamin B6, folacin, magnesium, iron, and zinc was low.

One way to increase consumption, particularly for female patients, would be to promote awareness about the importance of consuming adequate amounts of calories and nutrients during and after hospitalization. The results of the present evaluation indicated that some patients were using their time in the hospital as an opportunity to lose weight.

Another way to increase caloric consumption would be to prepare the liquids with milk instead of water. Using milk instead of water would increase the caloric density of the ration without increasing its volume.

Patients reported that the portion size of many of the items of the new diet were slightly larger than was necessary. Since patients generally only consumed one-third to two-thirds of what they were served, it is recommended that the portion size of the new diet products be reduced from eight ounces to six ounces, if their caloric and nutrient content can be maintained at this reduced volume. This would increase nutrient intake for all patients.

In the present study, the milkshakes were often served with the meal. Since most patients were not able to consume all that was served to them at each meal, in order to increase overall daily consumption, it is recommended that the milkshakes be served between meals only.

Comparisons of the total volume of liquid consumed by patients each day from the new and current diets indicated that the quantities consumed were similar. However, since the actual nutrient and caloric intake of the current diet was not analyzed, it is not known whether nutrient and caloric intake of the two diets were also similar.

Acceptance ratings of the individual new diet products revealed that the new products were well-liked with the exception of certain vegetables and breakfast foods. Items such as glazed carrots and peas and carrots received only neutral ratings, so it is recommended that these items be reformulated or replaced. It is recommended that some of the breakfast items be reformulated as well.

The acceptance of the new and current diets was compared by food categories. In general, all of the food categories were

acceptable for both diets (ratings were above the neutral point) in appearance, flavor, consistency, texture, ease of sipping, and overall acceptability. However, there were some differences between the new and current diets in the acceptance of certain food categories.

The consistency, texture, and ease of sipping of the milkshakes and the lunch and dinner entrees (which mainly consisted of meats) were rated significantly higher for the new products than for the current products. On the other hand, the current milkshakes and breakfast products reportedly had better flavor and received higher overall acceptability ratings than the new products. In addition, the current vegetables (which included vegetable soups) were perceived to be smoother, less gritty, and easier to sip than the new vegetables.

Since the vegetable soups that are part of the current diet received high acceptance ratings, particularly in comparison to the new vegetables, it may be beneficial to replace some of the vegetables in the new diet with soups. Because soups are familiar in liquid form, another way to increase the acceptability of the liquid vegetables might be to call these products "soups" rather than vegetables.

A recommendation that was made by a number of patients was to include separate packets of spices and other condiments that could be added to the liquids to enhance their flavor.

Dietitians indicated a clear preference for the new liquid products over the current products because of several major advantages relating to preparation. The new products are much easier to prepare, and require significantly less time to prepare

than the current products. The new products are standardized; therefore the liquids are the same each time they are prepared, and the nutrient content can be accurately determined. The new products are also much more sanitary to prepare than the current products because there is only one step to preparation. Minimal storage requirements and long shelf life are additional benefits.

Dietitians at all hospitals that participated in the evaluation, with the exception of one, felt that the products were well-liked by the patients and recommended their continued use. The major suggestion for improving the new diet was to develop a longer and more varied menu. Currently (July 1988), a five-day menu is being developed that will include 50 different menu items and six flavors of the nutritional supplement.

Dietitians also recommended that packages of multiple servings of the products be available in addition to individual servings for hospitals at which liquid diets generally have to be prepared for several patients at one time.

Given that there were no differences in the volume consumed of the new and current products, and given that both diets were generally acceptable, it is concluded that the new diet is superior to the current diet because of its major advantages relating to preparation. It is recommended that additional products be developed and tested for use in hospitals as well as for use in the field. Because most liquid diet patients must consume liquid diets for weeks or even months, and because patients are often not aware of how to prepare a nutritious liquid diet on their own, there is a great need for products that could be easily prepared by patients once they are discharged from the

hospital. The new diet would serve these additional needs as well.

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APPENDICES

A. Two-Day Menu -- Nutrient Information

B. Between-Meal Supplements -- Nutrient Information

C. Volunteer Agreement Form

D. Patient Information Form

E. Menu Schedule

F. Dietitian Consumption Record

G. Patient Consumption Record

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I. Dietitian Questionnaire

J. Acceptance Ratings of Individual New Liquid Diet Products

K. Comparison of Acceptance Ratings of the New and Current Diets

L. Comparison of Individual New and Current Diet Products

M. Comparison of the New and Current Diet on Variety; Meal Size; Overall Satisfaction; and Mood, Pain, and Hunger

APPENDIX A. TWO-DAY MENUS -- NUTRIENT INFORMATION

LIQUID MEAL MENU

Day 1

Breakfast

Juice

French Toast*

Grits*

Milk Hot Chocolate/Coffee/Tea

Midday Meal

Juice

Beef with Spaghetti Sauce*

Noodles Parmesan* Peas and Carrots*

Apple Pie*

Milk Hot Chocolate/Coffee/Tea

Evening Meal

Juice

Beef and Gravy*

Mashed Potatoes* Glazed Carrots*

Chocolate Pudding*

Milk Hot Chocolate/Coffee/Tea

Snacks: Juices, Milkshakes, Carbonated Beverages

*Dental liquid items

LIQUID MEAL MENU

Day 2

Breakfast

Juice

Cheese Omelet*

Farina*

Milk Hot Chocolate/Coffee/Tea

Midday Meal

Juice

Turkey and Gravy*

Candied Sweet Potatoes* Cauliflower au Gratin*

Chocolate Peppermint Pudding*

Milk Hot Chocolate/Coffee/Tea

Evening Meal

Juice

Chili*

Macaroni and Cheese* Buttered Corn*

Vanilla Pudding*

Milk Hot Chocolate/Coffee/Tea

Snacks: Juices, Milkshakes, Carbonated Beverages

*Dental liquid items

10 DECEMBER 1986

TABLE A-1. DENTAL LIQUI
PROXIMATE CONTENTS PER SER
MENU 1 G

	Weight (g)	Water (g)	Protein (g)	Fat (g)	Cho (g)
Breakfast					
French Toast	45.0	1.1	7.3	21.0	14.1
Hominy Grits	25.0	0.8	3.4	4.3	15.3
Nutrional Supplement	100.0	2.5	18.7	9.0	65.0
Lunch					
Spaghetti	45.0	3.2	14.9	7.8	16.1
Noodles Parmesan	35.0	0.8	7.2	10.4	14.7
Peas and Carrots	30.0	0.9	4.2	10.4	13.2
Apple Pie	60.0	1.7	2.6	8.4	45.8
Nutrional Supplement	100.0	2.5	18.7	9.0	65.0
Dinner					
Beef and Gravy	45.0	1.5	11.3	16.4	10.7
Mashed Potatoes	32.0	1.0	3.5	9.8	15.6
Glazed Carrots	30.0	1.4	1.8	7.7	16.8
Chocolate Pudding	80.0	1.5	8.8	22.0	45.8
Nutrional Supplement	100.0	2.5	18.7	9.0	65.0
Totals	727.0	21.4	121.0	145.3	402.9

	Fiber (g)	Ash (g)	kcal	kcal/fat (%)
Breakfast				
French Toast	0.5	1.5	274.6	68.9
Hominy Grits	0.4	1.3	112.9	33.9
Nutrional Supplement		4.8	415.6	19.5
Lunch				
Spaghetti	0.7	2.7	194.5	36.2
Noodles Parmesan	0.1	1.9	181.4	51.8
Peas and Carrots	1.8	1.3	163.3	57.5
Apple Pie	0.8	1.4	269.3	28.1
Nutrional Supplement		4.8	415.6	19.5
Dinner				
Beef and Gravy	0.7	2.5	236.0	62.6
Mashed Potatoes	0.3	2.1	164.6	53.7
Glazed Carrots	1.4	2.3	143.8	48.3
Chocolate Pudding	1.7	1.9	416.2	47.6
Nutrional Supplement		4.8	415.6	19.5
Totals	8.5	33.5	3403.4	38.4

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MENU 2

Breakfast	Weight (g)	Water (g)	Protein (g)	Fat (g)	Cho (g)
Cheese Omelet	40.0	1.2	12.0	16.3	7.1
Farina Cereal	30.0	0.6	4.5	7.8	16.1
Nutritional Supplement	100.0	2.5	18.7	9.0	65.0
Lunch					
Turkey and Gravy	35.0	1.5	12.5	7.7	9.0
Sweet Potatoes	40.0	1.5	1.1	7.4	28.8
Cauliflower	30.0	1.0	8.3	11.1	7.4
Choc.Pep.Pudding	80.0	1.1	8.3	23.9	44.6
Nutritional Supplement	100.0	2.5	18.7	9.0	65.0
Dinner					
Chili	35.0	2.1	15.9	3.0	11.0
Macaroni and Cheese	45.0	0.8	9.5	17.8	14.2
Buttered Corn	40.0	1.0	3.4	9.3	24.6
Vanilla Pudding	80.0	1.2	7.3	23.9	45.8
Nutritional Supplement	100.0	2.5	18.7	9.0	65.0
Total	755.0	19.5	138.9	155.2	403.5

Breakfast	Fiber (g)	Ash (g)	kcal	kcal/fat (%)
Cheese Omelet	1.4	2.3	222.7	65.8
Farina Cereal	0.2	1.0	152.5	45.9
Nutritional Supplement		4.8	415.6	19.5
Lunch				
Turkey and Gravy	0.7	2.6	154.9	44.5
Sweet Potatoes	6.1	1.2	186.3	35.8
Cauliflower	8.6	2.1	163.3	61.3
Choc.Pep.Pudding	1.0	2.0	427.1	50.4
Nutritional Supplement		4.8	415.6	19.5
Dinner				
Chili	1.3	3.0	135.1	20.3
Macaroni and Cheese	0.1	2.7	254.5	62.9
Buttered Corn	0.5	1.8	195.7	42.9
Vanilla Pudding	0.3	1.8	427.8	50.3
Nutritional Supplement		4.8	415.6	19.5
Total	20.3	35.0	3566.6	39.2

MENU 1
FORTIFIED

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TABLE A-2. DENTAL LIQUIDS
MINERALS PER SERVING

	Weight (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)
Breakfast					
French Toast	45.0	60.5	163.8	1.6	362.9
Hominy Grits	25.0	44.0	61.8	0.6	340.0
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Lunch					
Spaghetti	45.0	97.4	236.7	5.5	488.3
Noodles Parmesan	35.0	107.5	131.3	0.7	461.3
Peas and Carrots	30.0	37.8	61.4	1.7	340.8
Apple Pie	60.0	73.2	62.1	1.8	331.8
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Dinner					
Beef and Gravy	45.0	35.3	110.5	4.0	709.2
Mashed Potatoes	32.0	65.6	73.6	0.4	521.3
Carrots	30.0	49.2	32.1	0.5	735.0
Chocolate Pudding	80.0	124.8	182.0	1.6	354.4
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Total	727.0	2585.3	2333.1	19.4	5524.0

	K (mg)	Mg (mg)	Cl (g)	Zn (mg)
Breakfast				
French Toast	204.3	21.2	0.9	0.9
Hominy Grits	113.5	12.0	0.9	0.3
Nutritional Supplement	1144.0	60.0	0.8	2.0
Lunch				
Spaghetti	572.9	42.1	1.2	3.9
Noodles Parmesan	152.3	18.2	1.1	0.7
Peas and Carrots	208.2	25.8	0.9	0.7
Apple Pie	243.6	36.3	0.8	0.5
Nutritional Supplement	1144.0	60.0	0.8	2.0
Dinner				
Beef and Gravy	296.3	21.6	1.6	1.8
Mashed Potatoes	335.0	19.4	1.3	0.5
Carrots	326.4	16.1	1.7	0.2
Chocolate Pudding	334.8	43.2	0.8	1.2
Nutritional Supplement	1144.0	60.0	0.8	2.0
Total	6219.3	435.8	13.6	16.6

MENU 2

DENTAL LIQUIDS
MINERALS PER SERVING
10 DECEMBER 1986

Breakfast	Weight (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)
Cheese Omelet	40.0	240.6	256.2	1.0	409.2
Farina Cereal	30.0	75.0	124.7	0.9	162.9
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Lunch					
Turkey and Gravy	35.0	29.2	127.1	1.1	781.2
Sweet Potatoes	40.0	22.2	22.3	2.1	340.8
Cauliflower	30.0	158.3	164.7	0.7	400.4
Choc.Pep.Pudding	80.0	110.8	192.8	3.9	333.6
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Dinner					
Chili	35.0	27.1	154.5	3.2	879.7
Macaroni and Cheese	45.0	181.4	190.6	0.9	770.0
Buttered Corn	40.0	22.7	78.2	0.9	520.8
Vanilla Pudding	80.0	112.0	155.6	3.1	350.4
Nutritional Supplement	100.0	630.0	406.0	0.3	293.0
Total	755.0	2869.3	2684.6	18.6	5827.9

Breakfast	K (mg)	Mg (mg)	Cl (g)	Zn (mg)
Cheese Omelet	257.4	21.6	0.4	1.6
Farina Cereal	161.7	28.6	0.2	0.6
Nutritional Supplement	1144.0	60.0	0.8	2.0
Lunch				
Turkey and Gravy	240.3	19.7	1.0	0.9
Sweet Potatoes	196.0	15.7	0.3	0.4
Cauliflower	257.4	21.8	0.5	1.1
Choc.Pep.Pudding	340.0	48.4	0.3	1.3
Nutritional Supplement	1144.0	60.0	0.8	2.0
Dinner				
Chili	459.4	34.1	1.1	2.6
Macaroni and Cheese	151.9	20.5	0.4	1.2
Buttered Corn	188.0	23.0	0.4	0.8
Vanilla Pudding	230.4	39.7	0.2	0.8
Nutritional Supplement	1144.0	60.0	0.8	2.0
Total	5914.4	453.0	7.0	17.2

MENU 1

TABLE A-3. DENTAL LIQUIDS VITAMINS PER SERVING 11 DECEMBER 1986

Breakfast	Serving (g)	Total A iu	Retinol Equiv.	Ascorbic (mg)	Thiamin (mg)
French Toast	45.0	1044.0	293.5	0.0	0.1
Hominy Grits	25.0	0.0	0.0	0.0	0.1
Nutritional Supplement	100.0	1517.5	459.8		0.1
Lunch					
Spaghetti	45.0	190.8	19.1	0.0	0.1
Noodles Parmesan	35.0	121.8	12.2	0.0	0.1
Peas and Carrots	30.0	6915.0	691.5	0.0	0.1
Apple Pie	60.0	446.4	135.3	0.0	.0
Nutrional Supplement	100.0	1517.5	459.8		0.1
Dinner					
Beef and Gravy	45.0	0.0	0.0	0.0	0.1
Mashed Potatoes	32.0	749.4	227.1	0.0	0.1
Carrots	30.0	12540.0	1254.0	232.2	.0
Chocolate Pudding	80.0	774.8	234.8	0.0	1.9
Nutritional Supplement	100.0	1517.5	459.8		0.1
Total	727.0	27334.7	4246.8	232.2	3.0

Breakfast	Riboflavi (mg)	Niacin (mg)	Pyridoxin (mg)	Folacin (mcg)
French Toast	0.3	1.1	.0	15.5
Hominy Grits	0.1	0.8	.0	1.3
Nutritional Supplement	0.9	0.6	0.1	12.0
Lunch				
Spaghetti	0.2	5.8	0.1	16.6
Noodles Parmesan	0.2	0.5	.0	2.2
Peas and Carrots	0.1	1.1	.0	10.8
Apple Pie	0.1	0.2	0.1	1.4
Nutrional Supplement	0.9	0.6	0.1	12.0
Dinner				
Beef and Gravy	0.1	2.6	0.1	14.8
Mashed Potatoes	0.1	0.9	0.1	7.6
Carrots	.0	0.6	0.1	8.5
Chocolate Pudding	0.2	16.6	2.6	473.3
Nutritional Supplement	0.9	0.6	0.1	12.0
Total	3.9	32.1	3.5	587.9

Breakfast	Vit. B 12 (mcg)	Vit. E (mg)
French Toast	0.5	1.2
Hominy Grits	0.0	1.3
Nutritional Supplement		1.8
Lunch		
Spaghetti	1.3	0.9
Noodles Parmesan	0.0	3.7
Peas and Carrots	0.0	2.5
Apple Pie	0.0	0.6
Nutrional Supplement		1.8
Dinner		
Beef and Gravy	0.8	1.9
Mashed Potatoes	0.0	1.9
Carrots	0.0	2.4
Chocolate Pudding	7.0	1.4
Nutritional Supplement		1.8
Total	9.6	23.0

MENU 2

Breakfast	Serving g	Total A iu	Retinol Equiv	Ascorbic mg	Thiamin mg
Cheese Omelet	40.0	621.2	188.2	0.0	.0
Farina Cereal	30.0	0.0	0.0	0.0	0.1
Nutritional Supplement	100.0	1517.5	459.8		0.1
Lunch					
Turkey and Gravy	35.0	0.0	0.0	0.0	.0
Sweet Potatoes	40.0	2459.2	245.9	100.0	.0
Cauliflower	30.0	345.0	104.5	0.0	.0
Choc.Pep.Pudding	80.0	699.2	211.9	0.0	2.3
Nutritional Supplement	100.0	1517.5	459.8		0.1
Dinner					
Chili	35.0	165.6	16.6	2.7	0.1
Macaroni and Cheese	45.0	618.3	187.4	0.0	0.1
Buttered Corn	40.0	958.4	234.6	0.0	.0
Vanilla Pudding	80.0	663.2	201.0	0.0	.0
Nutritional Supplement	100.0	1517.5	459.8		0.1
Total	755.0	11082.6	2769.4	102.7	3.2

Breakfast	Riboflavi mg	Niacin mg	Pyridoxin mg	Folacin mcg
Cheese Omelet	0.3	0.2	.0	9.7
Farina Cereal	0.1	0.2	.0	4.3
Nutritional Supplement	0.9	0.6	0.1	12.0
Lunch				
Turkey and Gravy	0.1	4.4	0.1	7.0
Sweet Potatoes	.0	.0	.0	2.0
Cauliflower	0.2	0.5	.0	18.0
Choc.Pep.Pudding	0.3	16.8	2.6	474.0
Nutritional Supplement	0.9	0.6	0.1	12.0
Dinner				
Chili	0.1	3.6	0.1	13.1
Macaroni and Cheese	0.2	0.4	.0	7.0
Buttered Corn	0.1	1.2	.0	4.9
Vanilla Pudding	0.3	0.4	0.1	1.8
Nutritional Supplement	0.9	0.6	0.1	12.0
Total	4.3	29.8	3.3	577.9

Breakfast	Vit. B 12 mcg	Vit. E mg
Cheese Omelet	0.7	0.9
Farina Cereal	0.0	1.0
Nutritional Supplement		1.8
Lunch		
Turkey and Gravy	0.2	1.9
Sweet Potatoes	0.0	2.3
Cauliflower	0.0	0.9
Choc.Pep.Pudding	7.0	1.8
Nutritional Supplement		1.8
Dinner		
Chili	0.7	0.3
Macaroni and Cheese	0.2	1.6
Buttered Corn	0.0	2.3
Vanilla Pudding	0.0	1.7
Nutritional Supplement		1.8
Total	8.8	20.1

APPENDIX B. BETWEEN-MEAL SUPPLEMENTS -- NUTRIENT INFORMATION

TABLE B-1. NUTRITIONAL SUPPLEMENTS

(per one 8-ounce serving)

CHO (g)	65.0
Protein (g)	18.7
Fat (g)	9.0
Kilocalories	415.6
Calcium (mg)	630.0
Phosphorous (mg)	410.0
Iron (mg)	0.3
Sodium (mg)	293.0
Potassium (mg)	1144.0
Magnesium (mg)	60.0
Chloride as NaCl (mg)	800.0
Zinc (mg)	2.0
Vitamin A (R.E.)	454.5
Thiamine (mg)	0.1
Riboflavin (mg)	0.8
Niacin (mg)	0.6
Pyridoxine (mg)	0.1
Folacin (mcg)	12.0
Vitamin E (mg)	1.8

APPENDIX C. VOLUNTEER AGREEMENT FORM

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 40-38; the proponent agency is the Office of the Surgeon General

THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974

1. AUTHORITY: 10 USC 3012, 44 USC 3101 and 10 USC 1071-1087.

2. PRINCIPAL PURPOSE: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purpose.

3. ROUTINE USES: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; teaching; adjudication of claims; and for the mandatory reporting of medical condition as required by law. Information may be furnished to Federal, State and local agencies.

4. MANDATORY OR VOLUNTARY DISCLOSURE: The furnishing of SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A - VOLUNTEER AFFIDAVIT

VOLUNTEER SUBJECTS IN APPROVED DEPARTMENT OF THE ARMY RESEARCH STUDIES

Volunteers under the provisions of AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____ SSN _____ having
(last, first, middle)

full capacity to consent and having attained my _____ birthday, do hereby volunteer to participate in

Advanced Liquid Diet Evaluation
(research study)

under direction of Dianne Engell, Ph.D. conducted at _____
(name of institution)

(to be filled out at hospital)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

(Hospital POC - to be filled out at each institution)

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights on study-related injury I may contact

Office of the Chief Counsel

at _____
(name and address of hospital & phone number (include area code))

(to be filled out at hospital)

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without further penalty or loss of benefits however, I may be ☒ required (military volunteer) or ☐ requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.) Detailed explanation on back.

PHYSICIAN'S CONSENT:

I approve of my patient _____ participating in this study to
(print name)

evaluate new liquid diet products. I have read the description of the study on the reverse side of this page.

_____, MD
(print name)

_____, MD
(signature)

(CONTINUE ON REVERSE)

VOLUNTEER'S EXPLANATION

Several new products for the military hospital advanced liquid diet have been developed by the U.S. Army Natick Research, Development and Engineering Center. The food scientists at NATICK would like to know how these new liquid foods compare to those currently in the system. Soldiers in 12 military hospitals (Army, Air Force and Navy) will be participating in this study to evaluate the liquid diet products.

Because you are a patient who is limited to consuming only liquid foods, your opinions and comments are very important in helping the food scientists improve the liquid diet products. Military patients who are restricted to liquid meals will benefit from your participation. You will receive no direct benefits from your participation in this study other than the knowledge and experience you may gain from the medical examination and study procedures.

If you volunteer to participate in this four-day evaluation, the new products will replace the main components of the current hospital liquid meals and some between-meal snacks for two days. You will still be able to drink juices, milk, and other beverages that usually accompany your meals. For the other two days, you will receive the currently served liquid meals. During each meal and snack time, you will be asked to complete two forms: the first, to rate the acceptability of the meal and snack items, and the second, to estimate the amount of each item you consumed.

The components of the new liquid meals are made from fresh ingredients, freeze dried, and then ground into a powder. The powdered foods are reconstituted by the nutrition care personnel in the hospital by adding water. The test food products are wholesome and completely safe for consumption. The risk of contamination by microorganisms is no greater than in foods bought from a supermarket or any other commercial source.

If you have any questions about this study, feel free to ask or discuss them with the investigators at any time. If you wish to discuss the results of the study, you may do so but not until your participation is complete. If you volunteer for this study, we would like to be reasonably certain that you will complete it. But you have the right to withdraw from this study at any time without adverse consequences or prejudice.

All data and information obtained about you as an individual will be considered privileged and held in confidence. Complete confidentiality cannot be promised, particularly to subjects who are military members, because information bearing on your health may be required to be reported to appropriate medical or Command authorities, and applicable regulations note the possibility that the Food and Drug Administration and USAMRDC officials may inspect the records.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor)
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS	DATE SIGNED

APPENDIX D. PATIENT INFORMATION FORM

PATIENT INFORMATION

This questionnaire must be completed by a dietitian or diet technician for every patient who is participating in the commercially prepared Hospital Liquid Diet Evaluation.

DATE_____

PATIENT'S NAME_____AGE_____

HEIGHT_____WEIGHT_____MALE_____FEMALE_____

HOSPITAL_____

DIETITIAN'S NAME_____

1. What is the medical reason for placing this patient on a liquid diet? Please check one.
   ____ a. dental procedure/surgery
   ____ b. jaw injury
   ____ c. other (specify) _____

2. Up to the present time, how long has the patient subsisted on an advanced liquid diet? number of days _____

3. What is the estimated amount of time that the patient will remain on an advanced liquid diet? number of days _____

4. Please list any medications and/or vitamins the patient is currently receiving.

_____
_____
_____

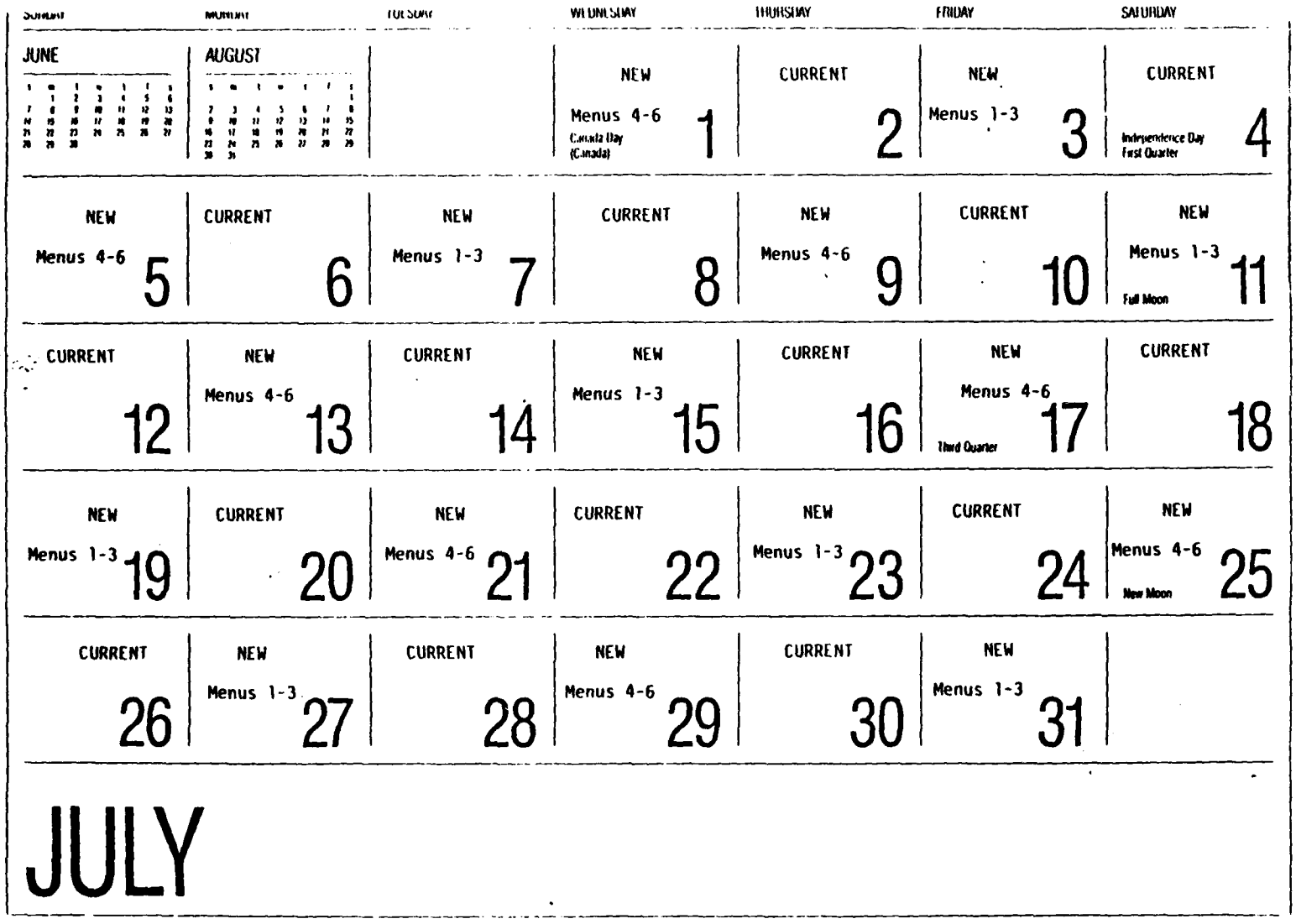
5. Please add any other pertinent information regarding the overall well being of this patient (e.g. food allergies).

_____
_____
_____

6. Is this patient currently trying to lose or gain weight? If so, please explain.

_____
_____
_____
_____

APPENDIX E. MENU SCHEDULE



Sample Menu Schedule, July, 1987

APPENDIX F. DIETITIAN CONSUMPTION RECORD

PATIENT'S NAME _____ DATE _____

HOSPITAL _____

DIETITIAN CONSUMPTION RECORD

LUNCH - CURRENT DIET

Please indicate how much of each of the following items this patient consumed by subtracting the volume of the leftover portion from the initial volume.

MEAL ITEMS	VOLUME Before Meal (ml)	After Meal (ml)	Amount Consumed (ml)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Beverages (specify)			
_____	_____	_____	_____
_____	_____	_____	_____
Milk Shake Flavor _____	_____	_____	_____

SNACKS	Before (ml)	After (ml)	Amount Consumed (ml)
Juice	_____	_____	_____
Milk	_____	_____	_____
Coffee	_____	_____	_____
Tea	_____	_____	_____
Hot Chocolate	_____	_____	_____
Carbonated Beverage	_____	_____	_____
Milk Shake Flavor _____	_____	_____	_____
Other (specify)			
_____	_____	_____	_____
_____	_____	_____	_____

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APPENDIX G. PATIENT CONSUMPTION RECORD

NAME _____ DATE _____

HOSPITAL _____

PATIENT CONSUMPTION RECORD

LUNCH

Please estimate how much of each of the following items you consumed. If you had more than one portion, write in the total amount in the designated column.

MEAL ITEMS	Serving Size	Amount Consumed					Total
Turkey and Gravy	_____	0	1/4	1/2	3/4	all	_____
Sweet Potatoes	_____	0	1/4	1/2	3/4	all	_____
Cauliflower au gratin	_____	0	1/4	1/2	3/4	all	_____
Chocolate Peppermint Pudding	_____	0	1/4	1/2	3/4	all	_____
Beverages (specify)							
_____	_____	0	1/4	1/2	3/4	all	_____
_____	_____	0	1/4	1/2	3/4	all	_____
Milk Shake Flavor _____	_____	0	1/4	1/2	3/4	all	_____

SNACKS	Serving Size	Amount Consumed					Total
Juice	_____	0	1/4	1/2	3/4	all	_____
Milk	_____	0	1/4	1/2	3/4	all	_____
Coffee	_____	0	1/4	1/2	3/4	all	_____
Tea	_____	0	1/4	1/2	3/4	all	_____
Hot Chocolate	_____	0	1/4	1/2	3/4	all	_____
Carbonated Beverage	_____	0	1/4	1/2	3/4	all	_____
Milk Shake Flavor _____	_____	0	1/4	1/2	3/4	all	_____
Other (specify)							
_____	_____	0	1/4	1/2	3/4	all	_____
_____	_____	0	1/4	1/2	3/4	all	_____

APPENDIX H. PATIENT QUESTIONNAIRE

NAME DATE

HOSPITAL EVENING MEAL

PATIENT QUESTIONNAIRE

GENERAL ASPECTS OF DENTAL LIQUID MEAL

Rate each product on appearance, flavor, consistency, texture, ease of sipping, portion size and overall acceptability. Circle the number that best describes your opinion of each product. Circle "0" if you did not try the item.

1. APPEARANCE

	0 Did Not Try	1 Extremely Unattractive	2	3	4	5 Neutral	6	7	8	9 Extremely Attractive
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

2. FLAVOR

	0 Did Not Try	1 Poor	2	3	4	5 Neutral	6	7	8	9 Excellent
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

3. CONSISTENCY

	Did Not Try	Extremely Lumpy				Moderately Lumpy				Not Lumpy (Smooth)
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

4. TEXTURE

	Did Not Try	Extremely Gritty				Moderately Gritty				Not Gritty
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

5. EASE OF SIPPING

	Did Not Try	Extremely Difficult				Neither Easy Nor Difficult				Extremely Easy
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

6. PORTION SIZE

	Did Not Try	Much Too Small				Just Right				Much Too Large
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

7. OVERALL ACCEPTABILITY

	Did Not Try	Dislike Extremely				Neither Like Nor Dislike				Like Extremely
Beef and Gravy	0	1	2	3	4	5	6	7	8	9
Mashed Potatoes	0	1	2	3	4	5	6	7	8	9
Glazed Carrots	0	1	2	3	4	5	6	7	8	9
Choc. Pudding	0	1	2	3	4	5	6	7	8	9
Milkshake	0	1	2	3	4	5	6	7	8	9

Please rate variety, meal size, and overall satisfaction. Circle the number that best expresses your opinion.

8. VARIETY WITHIN EVENING MEAL

1 2 3 4 5 6 7 8 9
Poor Variety — Excellent Variety

9. MEAL SIZE (EVENING MEAL)

1 2 3 4 5 6 7 8 9
Much Too Small — Just Right — Much Too Large

10. OVERALL SATISFACTION WITH EVENING MEAL

1 2 3 4 5 6 7 8 9
Extremely Dissatisfied — Neutral — Extremely Satisfied

11. If you did not consume all the items you were served, please specify the reason for not doing so. _____

12. Please use this space for any additional comments you have about any aspect of this meal. _____

13. Please use the following two scales to express how you feel AT THIS MOMENT.

a. MOOD

1	2	3	4	5	6	7	8	9
Poor								Excellent

b. PAIN

0	1	2	3	4	5	6	7	8	9
No Pain	Very Mild Pain								Very Extreme Pain

The last questions concern your overall opinion about today's three meals.

14. Please rate the OVERALL VARIETY OF THE THREE MEALS.

1	2	3	4	5	6	7	8	9
Poor Variety								Excellent Variety

15. How often did you feel HUNGRY during the day?

0	1	2	3	4	5
Never	Almost Never	Sometimes	Often	Almost Always	Always

16 Please use this space for any other comments you have about today's meals. _____

APPENDIX I. DIETITIAN QUESTIONNAIRE

DIETITIAN QUESTIONNAIRE

NAME_____ DATE_____
HOSPITAL_____

Please answer every question. If it is appropriate for other nutrition care personnel to answer certain questions, please ask them to do so, and indicate their names and positions next to their answers/comments on the questionnaire.

1. What types of food products do you typically serve for advanced liquid diets? Please check the appropriate block.

	ENTREE	STARCH	VEG	DESSERT	SNACK
A. Pureed Regular Menu Items	___	___	___	___	___
B. Baby Foods	___	___	___	___	___
C. Commercial Liquid Product (specify product)_____	___	___	___	___	___
D. Commercial Dry Product (specify product)_____	___	___	___	___	___
E. Other (specify) _____	___	___	___	___	___

2. Please describe how you would typically prepare an advanced liquid diet menu. _____

3. What types of problems do you generally have when preparing advanced liquid diets? _____

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4. Please rate the current dental liquid products (the ones you usually serve), and the new dental liquid products on the following characteristics. Please circle the number that best expresses your opinion. Circle "0" if you have never prepared the item.

A. EASE OF PREPARATION

CURRENT PRODUCTS: (products you usually use)	Never Prepared	Extremely Difficult				Neither Easy Nor Difficult				Extremely Easy
entree	0	1	2	3	4	5	6	7	8	9
starch	0	1	2	3	4	5	6	7	8	9
vegetable	0	1	2	3	4	5	6	7	8	9
dessert	0	1	2	3	4	5	6	7	8	9
milkshake	0	1	2	3	4	5	6	7	8	9
NEW PRODUCTS:										
entree	0	1	2	3	4	5	6	7	8	9
starch	0	1	2	3	4	5	6	7	8	9
vegetable	0	1	2	3	4	5	6	7	8	9
dessert	0	1	2	3	4	5	6	7	8	9
milkshake	0	1	2	3	4	5	6	7	8	9

B. TIME REQUIREMENTS FOR PREPARATION

	Never Prepared	Poor (preparation takes much too much time)				Average				Excellent (preparation takes minimal time)
CURRENT PRODUCTS: (products you usually use)										
entree	0	1	2	3	4	5	6	7	8	9
starch	0	1	2	3	4	5	6	7	8	9
vegetable	0	1	2	3	4	5	6	7	8	9
dessert	0	1	2	3	4	5	6	7	8	9
milkshake	0	1	2	3	4	5	6	7	8	9
NEW PRODUCTS:										
entree	0	1	2	3	4	5	6	7	8	9
starch	0	1	2	3	4	5	6	7	8	9
vegetable	0	1	2	3	4	5	6	7	8	9
dessert	0	1	2	3	4	5	5	7	8	9
milkshake	0	1	2	3	4	5	6	7	8	9

C. VARIETY BETWEEN MEALS

CURRENT PRODUCTS: (products you usually use)	Poor				Average				Excellent
entree	1	2	3	4	5	6	7	8	9
starch	1	2	3	4	5	6	7	8	9
vegetable	1	2	3	4	5	6	7	8	9
dessert	1	2	3	4	5	6	7	8	9
milkshake	1	2	3	4	5	6	7	8	9
NEW PRODUCTS:									
entree	1	2	3	4	5	6	7	8	9
starch	1	2	3	4	5	6	7	8	9
vegetable	1	2	3	4	5	6	7	8	9
dessert	1	2	3	4	5	6	7	8	9
milkshake	1	2	3	4	5	6	7	8	9

5. Please comment on the advantages/disadvantages of the current liquid diet products. _____

6. Please comment on the advantages/disadvantages of the new liquid diet products. _____

7. On the average, how many minutes did it take you to prepare an advanced liquid diet meal for one patient using:
   a). the new liquid diet products_____
   b). the current liquid diet products_____

8. What are your perceptions of patient satisfaction with the new liquid diet products? _____

9. Would you recommend the continued use of these new liquid diet products? Why or why not?_____

10. Would you recommend the development of additional new liquid diet products? Why or why not? What would you recommend?_____

11. Do you have any suggestions for improving the new liquid diet products?_____

12. Do you have any specific comments about each of the following new liquid diet products?

Cheese Omelet_____

Farina Wheat Cereal_____

Turkey and Gravy_____

Sweet Potatoes_____

Cauliflower_____

Choc. Peppermint Pudding_____

Chili_____

Macaroni and Cheese_____

Corn_____

Vanilla Pudding_____

French Toast_____

Grits_____

Beef with Spaghetti Sauce_____

Noodles Parmesan_____

Peas and Carrots_____

Apple Pie_____

Beef and Gravy_____

Mashed Potatoes_____

Carrots_____

Chocolate Pudding_____

Chocolate Milkshake_____

Vanilla Milkshake_____

Strawberry Milkshake_____

Banana Milkshake_____

Eggnog Milkshake_____

Orange Milkshake_____

13. Please use the space at the bottom of pages 2 - 4 for any additional comments you may have.

APPENDIX J. ACCEPTANCE RATINGS OF INDIVIDUAL NEW LIQUID DIET PRODUCTS

TABLE J-1.
NEW LIQUID DIET
APPEARANCE*

	Mean	Std Dev
Chocolate Milkshake	6.93	1.49
Eggnog Milkshake	6.91	1.76
Strawberry Milkshake	6.74	1.78
Vanilla Pudding	6.68	1.72
Chili	6.66	1.68
Banana Milkshake	6.65	1.87
Turkey and Gravy	6.63	1.74
Vanilla Milkshake	6.61	1.76
Macaroni and Cheese	6.61	1.51
Chocolate Pudding	6.52	1.70
Orange Milkshake	6.35	1.98
Chocolate Peppermint Pudding	6.25	2.07
Apple Pie	6.24	1.97
Buttered Corn	6.24	1.72
Beef and Gravy	6.20	1.96
Spaghetti with Beef	6.19	1.88
Mashed Potatoes	6.09	1.85
Cauliflower au Gratin	5.99	1.78
Noodles Parmesan	5.96	2.00
Grits	5.88	2.18
Farina Cereal	5.81	1.79
French Toast	5.66	2.17
Sweet Potatoes	5.45	2.20
Cheese Omelet	5.42	2.05
Glazed Carrots	4.91	2.15
Peas and Carrots	3.85	2.63

*1=Extremely Unattractive...9=Extremely Attractive

TABLE J-2.
NEW LIQUID DIET
FLAVOR*

	Mean	Std Dev
Chili	7.57	1.49
Turkey and Gravy	7.30	1.86
Banana Milkshake	7.06	1.82
Vanilla Pudding	7.05	1.74
Macaroni and Cheese	6.91	2.17
Strawberry Milkshake	6.86	2.11
Chocolate Milkshake	6.86	1.78
Eggnog Milkshake	6.81	2.20
Chocolate Peppermint Pudding	6.77	2.20
Beef and Gravy	6.75	2.03
Buttered Corn	6.72	1.98
Apple Pie	6.64	2.01
Vanilla Milkshake	6.51	2.09
Chocolate Pudding	6.51	1.99
Orange Milkshake	6.33	2.24
Spaghetti with Beef	6.30	2.35
Cauliflower au Gratin	6.21	1.93
Noodles Parmesan	6.15	2.26
Mashed Potatoes	5.90	2.30
French Toast	5.84	2.55
Farina Cereal	5.81	2.22
Cheese Omelet	5.56	2.38
Sweet Potatoes	5.28	2.27
Grits	5.26	2.54
Glazed Carrots	4.97	2.18
Peas and Carrots	4.67	2.75

*1=Poor...9=Excellent

TABLE J-3.
NEW LIQUID DIET
CONSISTENCY*

	Mean	Std Dev
Banana Milkshake	8.39	0.80
Chocolate Milkshake	8.15	1.22
Eggnog Milkshake	8.02	1.36
Strawberry Milkshake	8.02	1.35
Orange Milkshake	7.98	1.27
Vanilla Milkshake	7.86	1.40
Cheese Omelet	7.81	1.49
Macaroni and Cheese	7.69	1.23
Chili	7.68	1.36
Vanilla Pudding	7.61	1.66
Apple Pie	7.59	1.67
Spaghetti with Beef	7.58	1.73
Farina Cereal	7.55	1.56
Sweet Potatoes	7.50	1.55
Buttered Corn	7.48	1.29
French Toast	7.46	1.73
Beef and Gravy	7.42	1.61
Turkey and Gravy	7.37	1.62
Chocolate Peppermint Pudding	7.34	1.50
Noodles Parmesan	7.25	1.83
Chocolate Pudding	7.24	1.98
Peas and Carrots	7.16	2.00
Grits	7.09	2.02
Mashed Potatoes	6.86	1.91
Glazed Carrots	6.65	2.56
Cauliflower au Gratin	6.26	2.14

*1=Extremely Lumpy...9=Not Lumpy (Smooth)

TABLE J-4.
NEW LIQUID DIET
TEXTURE*

	Mean	Std Dev
Banana Milkshake	8.21	1.01
Eggnog Milkshake	8.19	1.05
Vanilla Milkshake	8.16	1.03
Orange Milkshake	8.09	1.20
Strawberry Milkshake	7.99	1.47
Chocolate Milkshake	7.93	1.36
Sweet Potatoes	7.91	1.14
Turkey and Gravy	7.85	1.32
Cheese Omelet	7.82	1.35
Vanilla Pudding	7.81	1.26
Chocolate Pudding	7.79	1.22
Macaroni and Cheese	7.70	1.43
Beef and Gravy	7.60	1.51
Buttered Corn	7.59	1.37
Chocolate Peppermint Pudding	7.58	1.48
Apple Pie	7.48	1.52
Peas and Carrots	7.47	1.65
Chili	7.38	1.74
Farina Cereal	7.35	1.62
Noodles Parmesan	7.32	1.82
Spaghetti with Beef	7.32	1.85
Mashed Potatoes	7.24	1.72
Glazed Carrots	7.21	2.27
French Toast	6.90	2.02
Cauliflower au Gratin	6.71	1.91
Grits	6.68	2.01

*1=Extremely Gritty...9=Not Gritty

TABLE J-5.
NEW LIQUID DIET
EASE OF SIPPING*

	Mean	Std Dev
Vanilla Milkshake	8.17	1.09
Banana Milkshake	8.08	1.42
Chocolate Milkshake	8.07	1.45
Orange Milkshake	8.04	1.31
Strawberry Milkshake	7.99	1.22
Eggnog Milkshake	7.94	1.47
Cheese Omelet	7.88	1.36
Sweet Potatoes	7.87	1.53
Macaroni and Cheese	7.80	1.39
Buttered Corn	7.75	1.29
Chili	7.64	1.76
Farina Cereal	7.47	1.64
Apple Pie	7.41	2.11
Spaghetti with Beef	7.37	2.13
Peas and Carrots	7.30	2.23
Grits	7.16	1.91
Noodles Parmesan	7.14	2.31
Turkey and Gravy	7.04	1.92
Beef and Gravy	6.99	2.07
Chocolate Peppermint Pudding	6.82	2.13
French Toast	6.72	2.25
Vanilla Pudding	6.67	2.52
Cauliflower au Gratin	6.56	2.23
Chocolate Pudding	6.25	2.62
Mashed Potatoes	6.22	2.33
Glazed Carrots	6.18	2.66

*1=Extremely Difficult...9=Extremely Easy

TABLE J-6.
NEW LIQUID DIET
PORTION SIZE*

	Mean	Std Dev
Peas and Carrots	6.83	1.86
Glazed Carrots	6.39	1.62
Apple Pie	6.11	1.90
Chocolate Pudding	6.04	1.75
Mashed Potatoes	6.00	1.64
Sweet Potatoes	5.94	1.61
Eggnog Milkshake	5.90	1.70
Beef and Gravy	5.90	1.55
Vanilla Milkshake	5.90	1.67
Chocolate Milkshake	5.89	1.71
Spaghetti with Beef	5.89	1.94
Cauliflower au Gratin	5.86	1.54
Banana Milkshake	5.84	1.56
Buttered Corn	5.84	1.46
Grits	5.82	1.76
Noodles Parmesan	5.80	1.84
Cheese Omelet	5.73	1.52
Orange Milkshake	5.73	1.56
Farina Cereal	5.72	1.57
Vanilla Pudding	5.72	1.50
Chocolate Peppermint Pudding	5.69	1.50
French Toast	5.64	1.61
Macaroni and Cheese	5.59	1.62
Chili	5.57	1.56
Turkey and Gravy	5.51	1.65
Strawberry Milkshake	5.33	1.89

*1=Much Too Small...9=Much Too Large

TABLE J-7.
NEW LIQUID DIET
OVERALL ACCEPTABILITY*

	Mean	Std Dev
Turkey and Gravy	7.27	1.84
Chili	7.21	1.71
Chocolate Milkshake	7.14	1.48
Beef and Gravy	7.09	1.71
Vanilla Pudding	6.93	1.92
Banana Milkshake	6.86	1.96
Strawberry Milkshake	6.86	2.03
Chocolate Pudding	6.84	1.90
Vanilla Milkshake	6.80	1.97
Macaroni and Cheese	6.76	2.22
Chocolate Peppermint Pudding	6.76	2.04
Apple Pie	6.60	1.97
Buttered Corn	6.58	2.06
Spaghetti with Beef	6.55	2.17
Noodles Parmesan	6.52	2.18
Eggnog Milkshake	6.50	2.37
Orange Milkshake	6.20	2.27
Mashed Potatoes	6.17	2.14
French Toast	5.94	2.32
Farina Cereal	5.94	2.15
Cauliflower au Gratin	5.93	2.07
Cheese Omelet	5.58	2.27
Grits	5.42	2.58
Sweet Potatoes	5.07	2.21
Glazed Carrots	4.94	2.45
Peas and Carrots	4.48	2.82

*1=Dislike Extremely...9=Like Extremely

APPENDIX K. COMPARISON OF ACCEPTANCE RATINGS OF THE NEW AND CURRENT DIETS

TABLE K-1.
DIET COMPARISONS
APPEARANCE*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	5.48	1.96	5.86	1.72			NS
Entrees	6.30	1.49	6.05	1.63			NS
Vegetables	5.17	1.79	5.53	1.81	-2.86	65	p<0.01
Starches	6.08	1.71	5.97	1.69			NS
Puddings	6.23	1.82	6.87	2.47			NS
Milkshakes	6.50	1.61	6.84	1.70			NS
Desserts	6.24	1.97	7.55	1.34			
Soup			6.33	1.98			
Fruit			6.16	2.10			

*1=Extremely Unattractive...9=Extremely Attractive

TABLE K-2.
DIET COMPARISONS
FLAVOR*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	5.50	1.83	6.11	2.06	-3.15	75	p<0.01
Entrees	6.84	1.65	6.90	1.72			NS
Vegetables	5.49	2.04	5.88	2.03			NS
Starches	6.13	2.02	6.08	2.09			NS
Puddings	6.57	1.87	7.40	2.64			NS
Milkshakes	6.59	1.66	7.16	1.67	-3.27	81	p<0.01
Desserts	6.64	2.01	8.19	0.92			
Soup			6.59	2.06			
Fruit			6.69	2.18			

*1=Poor...9=Excellent

TABLE K-3.
DIET COMPARISONS
CONSISTENCY*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	7.46	1.42	7.07	1.59	2.00	76	p<0.05
Entrees	7.44	1.30	6.78	1.64	4.49	80	p<0.001
Vegetables	6.85	1.63	7.59	1.27	-3.45	64	p=0.001
Starches	7.25	1.39	7.15	1.78			NS
Puddings	7.15	1.61	8.04	1.47			NS
Milkshakes	8.01	1.01	7.70	1.49	2.09	82	p<0.05
Desserts	7.59	1.67	7.67	1.66			
Soup			7.62	1.43			
Fruit			7.47	1.49			

*1=Extremely Lumpy...9=Not Lumpy (Smooth)

TABLE K-4.
DIET COMPARISONS
TEXTURE*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	7.11	1.60	6.98	1.59			NS
Entrees	7.56	1.39	6.84	1.76	3.24	79	p<0.01
Vegetables	7.26	1.43	7.62	1.30	-3.45	61	p=0.001
Starches	7.48	1.45	7.13	1.83			NS
Puddings	7.63	1.21	8.58	0.70			NS
Milkshakes	8.08	0.95	7.76	1.44	2.16	81	p<0.05
Desserts	7.48	1.52	7.81	1.56			
Soup			7.60	1.58			
Fruit			7.38	2.06			

*1=Extremely Gritty...9=Not Gritty

TABLE K-5.
DIET COMPARISONS
EASE OF SIPPING*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	7.12	1.73	6.77	1.83			NS
Entrees	7.12	1.93	6.77	1.91	2.41	79	p<0.05
Vegetables	6.88	1.98	7.69	1.22	-3.46	62	p=0.001
Starches	7.04	1.84	7.04	1.98			NS
Puddings	6.28	2.17	7.15	2.51			NS
Milkshakes	7.99	1.03	7.66	1.47	2.08	80	p<0.05
Desserts	7.41	2.11	7.94	1.15			
Soup			7.87	1.61			
Fruit			7.07	2.58			

*1=Extremely Difficult...9=Extremely Easy

TABLE K-6.
DIET COMPARISONS
PORTION SIZE*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	5.60	1.40	5.51	1.52			NS
Entrees	5.79	1.56	5.36	1.51	2.21	80	p<0.05
Vegetables	6.20	1.47	5.78	1.37	2.09	62	p<0.05
Starches	5.85	1.56	5.32	1.33	2.79	72	p<0.01
Puddings	5.82	1.40	5.43	0.76			NS
Milkshake	5.67	1.46	5.31	1.40	2.49	82	p<0.05
Desserts	6.11	1.90	4.21	1.95			
Soup			5.58	1.43			
Fruit			5.27	1.53			

*1=Much Too Small...9=Much Too Large

TABLE K-7.
DIET COMPARISONS
OVERALL ACCEPTABILITY*

	New		Current		T-test Results		
	Mean	Std Dev	Mean	Std Dev	t	df	p
Breakfast Foods	5.56	1.71	6.22	1.88	-3.07	75	p<0.01
Entrees	6.98	1.65	6.73	1.49			NS
Vegetables	5.33	2.07	5.97	1.91			NS
Starches	6.34	2.00	6.35	1.81			NS
Puddings	6.66	1.81	7.29	2.55			NS
Milkshakes	6.57	1.74	7.14	1.63	-3.24	81	p<0.01
Desserts	6.60	1.97	8.17	0.75			
Soup			6.87	1.71			
Fruit			7.03	2.30			

*1=Dislike Extremely...9=Like Extremely

APPENDIX L. COMPARISON OF INDIVIDUAL NEW AND CURRENT DIET PRODUCTS.

TABLE L-1
Comparison of Individual
New and Current Diet Products.

FOOD	FACTOR	NEW DIET (Mean)	CURRENT DIET (Mean)	T-TEST RESULTS t	df	p
Turkey	Texture	7.85	6.52	2.96	37	p<0.01
Beef	Consistency	7.42	6.68	2.30	127	p<0.05
Beef	Texture	7.60	6.78	2.52	119	p<0.05
Beef	Portion size	5.90	5.39	2.00	126	p<0.05
Potatoes	Ease of sipping	6.22	7.06	-2.29	119	p<0.05
Potatoes	Portion size	6.00	5.30	2.70	135	p<0.01
Vanilla Milkshake	Appearance	6.61	7.55	-2.98	74	p<0.01
Vanilla Milkshake	Flavor	6.51	7.99	-4.89	99	p<0.001
Vanilla Milkshake	Consistency	7.86	8.46	-2.80	96	p<0.01
Vanilla Milkshake	Overall Acceptability	6.80	8.01	-4.03	96	p<0.001

APPENDIX M. COMPARISON OF THE NEW AND CURRENT DIETS ON VARIETY; MEAL SIZE; OVERALL SATISFACTION; AND MOOD, PAIN, AND HUNGER

TABLE M-1.
DIET COMPARISONS
VARIETY*

	NEW			CURRENT		
Menu	Meal	Mean	SD	Meal	Mean	SD
1	Breakfast	5.89	1.90	Breakfast	5.59	1.56
2	Lunch	6.81	1.58	Lunch	6.71	1.48
3	Dinner	6.95	1.33	Dinner	6.78	1.43
4	Breakfast	5.72	1.90			
5	Lunch	6.50	1.82			
6	Dinner	6.99	1.60			

*1=Poor Variety...9=Excellent Variety

TABLE M-2.
DIET COMPARISONS
MEAL SIZE*

	NEW			CURRENT		
Menu	Meal	Mean	SD	Meal	Mean	SD
1	Breakfast	5.19	1.67	Breakfast	5.00	1.17
2	Lunch	5.95	1.71	Lunch	5.52	1.29
3	Dinner	5.98	1.53	Dinner	5.57	1.32
4	Breakfast	5.39	1.59			
5	Lunch	5.83	1.58			
6	Dinner	5.88	1.51			

*1=Much Too Small...9=Much Too Large

TABLE M-3.
DIET COMPARISONS
OVERALL SATISFACTION*

	NEW			CURRENT		
Menu	Meal	Mean	SD	Meal	Mean	SD
1	Breakfast	5.90	1.93	Breakfast	5.91	1.37
2	Lunch	5.97	2.01	Lunch	6.22	1.74
3	Dinner	6.40	1.54	Dinner	6.43	1.69
4	Breakfast	5.68	1.87			
5	Lunch	6.32	1.71			
6	Dinner	6.72	1.74			

*1=Extremely Dissatisfied...9=Extremely Satisfied

TABLE M-4.
DIET COMPARISONS
AVERAGE RATINGS OF MOOD, PAIN, AND HUNGER.

	New		Current	
	Mean	Std Dev	Mean	Std Dev
Mood[a]	6.40	2.00	6.31	1.84
Pain[b]	1.74	2.11	1.59	1.98
Hunger[c]	1.55	1.13	1.62	0.98

[a]1=Poor...9=Excellent
[b]0=No Pain...1=Very Mild Pain...9=Very Extreme Pain
[c]0=Never...5=Always